THE INSECTS AND ARACHNIDS OF CANADA

PART 15

The Metallic Wood-boring Beetles of Canada and Alaska

Coleoptera: Buprestidae

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Research Branch
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Part 14. The Grasshoppers, Crickets, and Related Insects of Canada and Adjacent Regions, by V.R. Vickery and D.K. McE. Kevan, Biosystematics Research Institute, Ottawa, 1986. 918 p. Price: Canada $36.95, other countries $44.35 (Canadian funds). Cat. No. A42.42/1985-14E.

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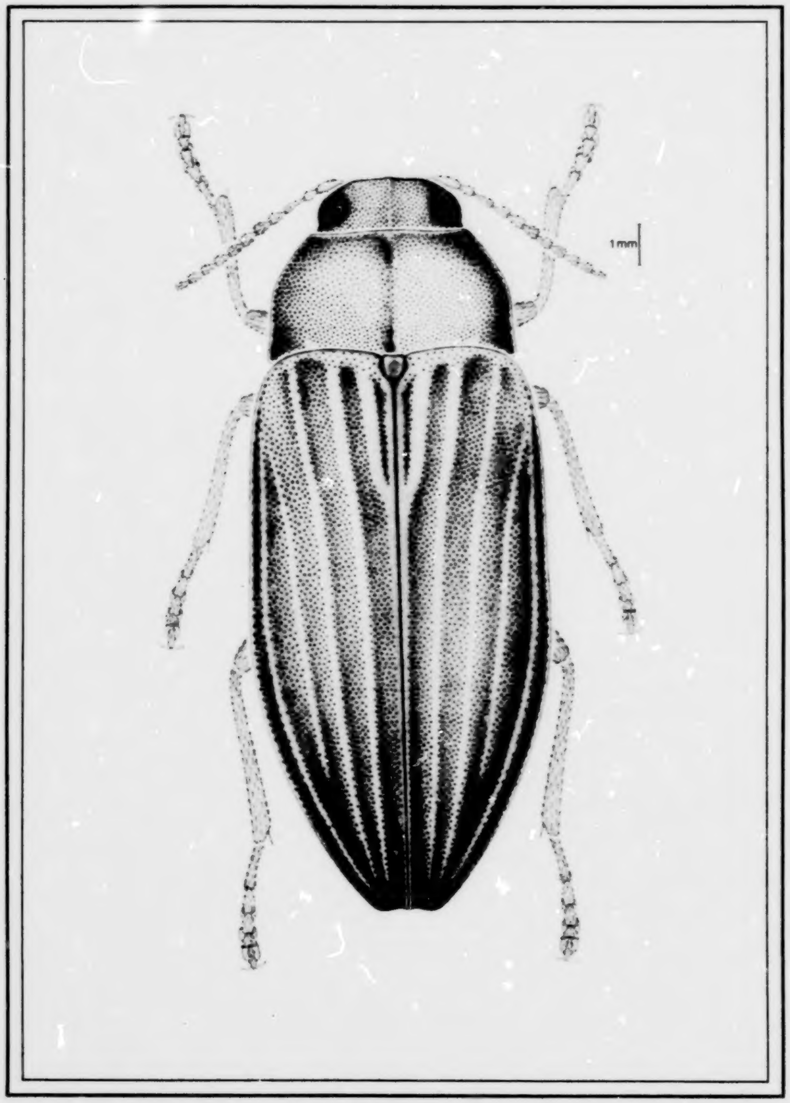

Frontispiece. ***Buprestis aurulenta*** Linneaus

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Introduction

Anyone who has spent time working or vacationing in the forested regions of North America is probably familiar with the family Buprestidae, or flatheaded borers. The larvae are large, white grubs shaped somewhat like a horseshoe nail and are common under bark of dead wood. The adults are flattened, compact, usually rather large, often bright-colored beetles with a metallic lustre. Both larvae and adults are conspicuous elements of the forest fauna. Because of the large size and brilliant colors of the adults, they are frequently collected and the family has been a favorite of collectors for many years.

The Buprestidae is a large and important family of beetles. The adults are exceedingly active on the wing and the larvae occur under the bark of various trees and woody plants. A few species attack and kill apparently healthy trees; most, however, attack weakened, dead, or recently felled trees. A few species breed in cones and seasoned wood; some are leaf miners. In general, the family is among the more destructive ones in the forest. They can also be considered beneficial because they aid the natural process of returning dead wood to soil.

The family name Buprestidae was first used by Stephens (1829) and Eschscholtz (1829). The name is composed of two Greek words: *bou* from *bous* cattle, and *prestis* from *prethein*, to blow up. These beetles were evidently thought to be poisonous to animals and were probably confused with meloids.

Fabricius (1801) split the Linnaean genus *Buprestis* into two genera, *Buprestis* and *Trachys*. Eschscholtz (1829) described the next six genera of North American buprestids.

About 12 000 species of Buprestidae are known worldwide. About 700 species are known from North America, and of these 189 occur or may occur in Canada and Alaska. Since the Buprestidae is essentially a tropical group, the Canadian fauna is almost always simply the northern extension of more widespread distributions farther south. Only about 12% of the Canadian species occur north of the 55° latitude.

The first step in any biological study is the correct identification of the subject. Numerous examples can be cited where a considerable amount of time and money was wasted because of incorrect identification of an economically important pest species. The purpose of this publication is to help amateur and professional entomologists, technical assistants, and students identify the Buprestidae of Canada and Alaska and to provide information on hosts, distribution, and biologies of the various species. Because of gaps in our knowledge, certain areas have had to be left in a less than complete form. These areas of deficiency are clearly pointed out so that others may attempt to resolve them.

The keys are written in an easy-to-follow style but in some instances male genitalia will need to be examined to correctly identify a specimen. Individual variation must also be taken into account. The keys not only include characters that do not vary but also those where variations do occur. However, not all variations that occur have been observed; therefore care is advised when using the keys.

When a specimen has been identified by using the keys, it should be compared with the description and with statements in the comments section. The descriptions contain more information than can be included in the keys and serve as an additional check. Obvious features that distinguish the species from all others are usually given in the comments section.

Under each species is a list of references. This list is not intended to be complete but only gives a reference to the original description and usually several subsequent references that contain additional information on biology, distribution, or ecology. All generic revisions are also given. Complete species references can be found in Obenberger (1926, 1937) and Chamberlin (1926). North American references will be found in G. Nelson's *Catalog of North American Coleoptera: Buprestidae* (in preparation). Diagnosis of subfamilies and tribes are not given here, since I feel they would be of limited use to the nonspecialist; such information can be found in Nelson (1981).

Biology

When known, specific biological data are given in the comments section. Host plants are recorded separately in the hosts section. Hosts listed are those in which larval development occurs or is believed to occur. Buprestid adults are often found resting on nonhost plants; therefore host records in the literature or on actual specimens must be used with care.

In those species that occur in woody plants, the eggs are generally laid singly or in masses on the bark surface, under scales, or in crevices or other bark irregularities; wound edges are favored sites. Hatching larvae bore directly through the egg shell into the bark and feed in the cambial layer, or in either the bark or the heartwood, or in two or more of these places. Their mines are winding, usually oval in cross section and packed tightly with layers of sawdustlike borings and fecal pellets and the walls are scarred with fine, transverse lines.

Pupal cells are often constructed in the heartwood, and connected to the surface by short, oval exit holes. Many wood-boring species spend the winter as adults in pupal cells.

Another group of buprestids has a different mode of life; these are the leaf miners. Eggs are laid on the upper leaf surface and the larvae feed within the leaf. Larval mines may be long and winding or blotchlike, most of them are located near the leaf edges. After becoming full-grown, the larvae leave the mines and fall to the ground, pupating on or slightly under the soil surface (***Brachys***) or remain in the mines through the pupal stage.

The general life cycle of each of the two groups differ. Leaf miners complete their prepupal development in 4–5 weeks, whereas the wood-borers require at least one full summer. The shorter development time is essential because of the ephemeral nature of leaves. Rapid development of the leaf miners is possible because of the smaller body size, and their habitat is rich in nutrients. Most wood-borers overwinter as adults (except Agrilinae), but some species spend the winter as larvae or pupae. However, they all remain in the host galley throughout the winter, the overwintering adults remain in the pupal cell until spring. The leaf miner genus ***Taphrocerus*** is apparently the only Nearctic buprestid genus in which the adults emerge in late summer, feed actively, then disperse to an overwintering site.

Adults of both the wood-boring and leaf-mining forms feed on foliage, pollen, or fungi. Adults are often found resting or feeding in bright-colored flowers or may be found resting on sunny bark surfaces or on foliage in full sun.

A few of our species have special habits such as cone feeders (*Chrysophana conicola*) and gall formers (*Agrilus* spp.). These are discussed further under the individual species.

Anatomy

The anatomical terms used in this work should be familiar to those who study Coleoptera. Detailed definitions of terms can be found by consulting Webster's Collegiate Dictionary, Torre-Bueno (1950), or the glossary at the end of this book.

To enable one to use the keys and diagnoses more easily, the following notes are given.

Head. The head of most buprestids is somewhat sunken into the prothorax, as wide as the prothorax, and generally convex with a more or less weakly impressed, longitudinal, median line. The *frons*, the area above the epistoma and between the eyes, is generally punctured or rugose. The *epistoma*, the lower margin of the frons above the mandibles, is frequently broadly sinute, emarginate, bilobed, or otherwise modified. It is an important feature in separating species of *Chrysobothris* and several other genera. The *antennae* are 11-segmented and usually serrate from the fourth segment. The *eyes* are moderate to large, elongate-oval, and placed on the side of the head.

Thorax. The *prothorax* is the first, or anterior, segment of the thorax, bearing the first pair of legs. It is roughly rectangular, usually slightly broader than long, with a well-developed pronotum. The lateral borders are usually sharply margined. The *disc*, or central dorsal portion, is punctate, rugose, striolate, or variously sculptured. The *prosternal process* is long and broad, extending posteriorly between the procoxae and inserted at the apex in the mesosternal fossa.

Elytra. The *elytra* are entire, rounded or acute at apex, with punctate or carinate *striae* and smooth or rugose *interstriae*. The scutellum is triangular or rounded, small to moderate, sometimes not visible.

Legs. The legs are generally slender, sometimes the *femora* are swollen and toothed. The *tibiae* are slender and spinose. The *tarsi* have five segments and the *tarsal claws* may be simple or cleft. The *hind coxal plates* may be roughly triangular, with the interior margin longer than the exterior (Fig. 23), or the internal and external margins may be about equal in length, giving a more rectangular shape to the plate (Fig. 24).

Abdomen. The *abdomen* has seven or eight visible tergites and five visible sternites, the first and second of which are connate, with a shallow suture between them or the suture may be partly obsolete. The ventral surface of the abdomen may be smooth, punctate, or finely rugose. The abdomen is completely covered by the elytra.

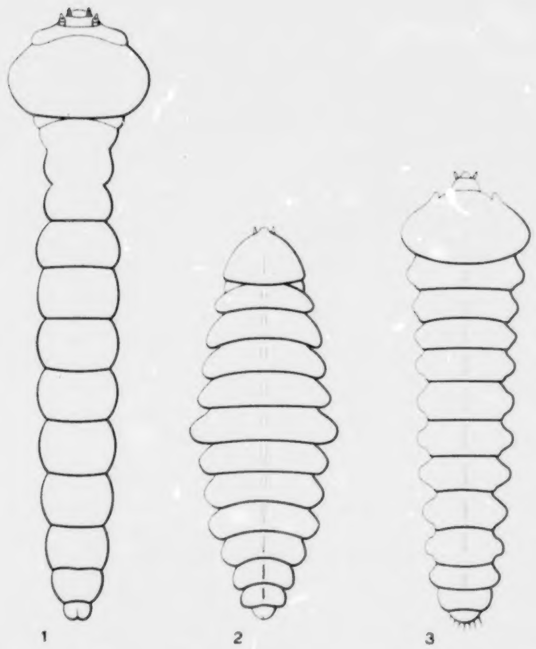
Genitalia. The *aedeagi* are usually heavily chitinized and always consist of a median lobe and two lateral lobes. They are similar to the aedeagi of the Elateridae but differ by having the basal piece and the lateral lobes consolidated and by the structure of the lateral and median lobes, which allows the median lobe to be extended beyond the tips of the lateral lobes. The aedeagi often show considerable differences between species and are valuable characters for separating species or for confirming identifications of individual specimens. The aedeagi are used in the keys in this book only where necessary to separate species, but illustrations of the aedeagi of most species are included to enable the user to check identifications.

Sexual dimorphism. Often the two sexes of the same species are slightly to distinctly different morphologically. The males are usually smaller and more slender than the females. Other differences are color, shape of eyes, width and sculpture of frons, length of antennae, pubescence of prosternal process, shape of terminal abdominal segment, shape of femora and tibiae, and structure of the inner margin of the tibiae.

Larvae

There are two general types of buprestid larvae in North America. The first type, which is the most commonly encountered one, is found under bark or in wood. It is flat-headed, with a broad first segment just behind the head (Fig. 1). The first segment, together with the second, third, and fourth, forms a broad, headlike division from the remaining segments, which form the long, cylindrical body. The broad first segment bears a central V-shaped groove on the dorsal side. The second type (leaf miners) is flattened, oval, deeply notched, and gradually tapers to the last segment (Figs. 2, 3). There is no distinct club head; the first and second segments are only slightly narrower or slightly broader than the third and fourth segments, and the whole body gradually tapers to the apex.

The larvae have not been studied during the preparation of this book. Burke (1917) has devised a key to distinguish most genera of buprestid larvae. Because his paper is not readily available to many workers, his key is presented below with updated names, modified to include only the genera which occur in Canada.



Figs. 1-3. Larval types. 1, *Melanophila drummondi*; 2, *Pachyschelus* sp.; 3, *Eupristocerus cognitans*.

Key to genera of buprestid larvae known to occur in Canada

(Adapted from Burke 1917)

1. First thoracic segment distinctly larger and broader than those following (Fig. 1); larvae club-shaped or pestle-shaped, somewhat flattened; bark- and wood-borers 2

First thoracic segment only slightly broader or slightly narrower than those following (Fig. 2); larvae wedge-shaped or spindle-shaped; leaf miners 16

2. Last abdominal segment without sclerotized projections 3

Last abdominal segment with two sclerotized projections 15

3. Plates of first thoracic segment with distinct sclerotized rugosites 4

Plates of first thoracic segment without distinct sclerotized rugosites 8

4. Rugosites of first thoracic segment tending to form ridges; plates with definite margins, markings dark and distinct 5

Rugosites of first thoracic segment pointlike (punctures); plates with indefinite margins, markings light-colored, appearing more or less as grooves than as definite lines 6

5. Dorsal plate marked with a distinct inverted Y ...... ***Chalcophora*** (p. 41)
Dorsal plate marked with a distinct inverted V or U ..... ***Texania*** (p. 47)

6. Dorsal plate marked with a short, inverted Y or U, rugose area forming more or less a hood around the Y; ventral plate marked with a median groove that extends from the posterior margin of the plate two-thirds or three quarters of the distance to the anterior margin, not bisecting the plate .... ***Buprestis*** (p. 94)
Dorsal plate marked with an inverted V formed by light grooves; ventral plate marked with a median groove that extends from the anterior margin of the plate almost to the posterior margin, sometimes bisecting the plate ... 7

7. Dorsal plate oblong; ventral plate narrow, almost rectangular, completely bisected by a median groove; first segment not much larger than second and third, fourth segment as large as fifth .... ***Melanophila*** (broad sense) (p. 124)
Dorsal plate circular; ventral plate circular, never completely bisected by a median groove; first segment much larger than others, fourth segment smaller than fifth .... ***Chrysobothris*** (p. 162)

8. Dorsal plate marked with an inverted V or Y formed by lines and grooves 9
Dorsal plate marked with a single median line or groove that may broaden out at either end 13

9. Dorsal marking an inverted V of deep grooves; ventral line not bisecting plate; third segment with a pair of ambulatory tubercles above and below, surface shining .... ***Anthaxia*** (broad sense) (p. 140)
Dorsal marking an inverted V or Y of dark lines; ventral line bisecting plate, surface dull 10

10. Dorsal and ventral markings with narrow, simple, anterior ends 11
Dorsal and ventral markings with broad, reticulated, anterior ends 12

11. Dorsal marking a long, inverted Y with brownish base; ventral marking a straight, bisecting line with brownish anterior end .... ***Spectralia*** (p. 49)
Dorsal marking an inverted V with a simple apex; ventral marking a simple bisecting groove .... ***Poecilonota*** (p. 79)

12. Dorsal marking an inverted Y with an impressed, shining, reticulated, diamond-shaped area surrounding apex .... ***Trachykele*** (p. 89)
Dorsal marking an inverted V with a broad, reticulated apex .... ***Dicerca*** (p. 51)

13. Fourth abdominal segment narrower than fifth 14
Fourth abdominal segment broader than fifth .... ***Acmaeodera*** (p. 32)

14. Grooves of first thoracic segment light-colored, plates not whitish opaque . ... ***Chrysophana*** (p. 28)
Grooves of first thoracic segment dark brown, plates whitish opaque .... ***Ptosima*** (p. 30)

15. Dorsal plate marked with two moderately separated, dark brown lines that converge anteriorly .... ***Eupristocerus*** (p. 218)
Dorsal plate marked with a single, median, bisecting line .. ***Agrilus*** (p. 220)

16. First thoracic segment as broad or slightly broader than following segments; body gradually tapering to 12th segment, slightly wedge-shaped .... ***Brachys*** (p. 304)
First thoracic segment narrower than following segments; body tapering to both ends from middle, more acute at posterior end, slightly spindle-shaped .. .. ***Pachyschelus*** (p. 298)

Tableau des genres de larves buprestides connues du Canada

(adaptée de Burke 1917)

1. Premier segment thoracique distinctement plus large que les suivants (fig. 1); larves en forme de massue ou de pilon un peu aplati; foreurs d'écorce et de bois 2

   Premier segment thoracique un peu plus large ou un peu plus étroit que les suivants (fig. 2); larves cunéiformes ou fusiformes; mineuses de feuilles 16

2. Dernier segment abdominal sans projections sclérifiées 3

   Dernier segment abdominal avec deux projections sclérifiées 15

3. Plaques du premier segment thoracique avec des rugosités sclérifiées distinctes 4

   Plaques du premier segment thoracique sans rugosités sclérifiées distinctes 8

4. Rugosités du premier segment thoracique tendant à former des carènes; plaques avec les marges bien délimitées, taches foncées et distinctes 5

   Rugosités du premier segment thoracique en forme de pointe; plaques avec les marges peu délimitées, taches pâles apparaissant plus ou moins comme des sillons plutôt que des lignes bien définies 6

5. Plaque dorsale avec un Y inversé .... ***Chalcophora*** (p. 41)

   Plaque dorsale avec un V ou un U inversé .... ***Texania*** (p. 47)

6. Plaque dorsale avec un Y ou un U court, tronqué et inversé, apex et tronc souvent peu perceptibles, zone rugueuse formant plus ou moins un capuchon autour du Y; plaque ventrale avec un sillon médian s'étendant de la marge antérieure de la plaque jusqu'aux deux-tiers ou aux trois-quarts postérieurs .... ***Buprestis*** (p. 94)

   Plaque dorsale avec un V inversé formé de légers sillons; plaque ventrale avec un sillon médian s'étendant de la marge antérieure de la plaque à presque la marge postérieure 7

7. Plaque dorsale oblongue; plaque ventrale étroite, presque rectangulaire, complètement divisée par un sillon médian; premier segment un peu plus large que les deuxième et troisième, le quatrième segment aussi large que le cinquième .... ***Melanophila*** (sens large) (p. 124)

   Plaque dorsale circulaire; plaque ventrale circulaire, jamais complètement divisée par un sillon médian; premier segment beaucoup plus large que les autres, quatrième segment plus petit que le cinquième .. ***Chrysobothris*** (p. 162)

8. Plaque dorsale avec un V ou un Y inversé formé de lignes et de sillons .. 9

   Plaque dorsale avec une ligne ou un sillon médian qui parfois s'élargi à chaque extrémité 13

9. Marque dorsale, un V inversé formé de profonds sillons; ligne ventrale ne divisant pas la plaque; troisième segment avec une paire de tubercules ambulatoires au-dessus et en-dessous; surface luisante .... ***Anthaxia*** (sens large) (p. 140)

   Marque dorsale, un V ou un Y inversé formé de lignes foncées; ligne ventrale divisant la plaque; surface mate 10

10. Marques dorsale et ventrale avec les extrémités antérieures étroites et simples 11

    Marques dorsale et ventrale avec les extrémités antérieures larges et réticulées 12

11. Marque dorsale, un long Y inversé et tronqué avec la base brunâtre; marque ventrale, une ligne droite avec l'extrémité antérieure brunâtre .... ***Spectralia*** (p. 49)

Marque dorsale, un V inversé avec l'apex simple; marque ventrale, un simple sillon .... *Poecilonota* (p. 79)

12. Marque dorsale, un Y inversé avec une zone autour de l'apex en forme de losange, luisante et réticulée .... *Trachykele* (p. 89)

Marque dorsale, un V inversé avec l'apex large et réticulé . *Dicerca* (p. 51)

13. Quatrième segment abdominal plus étroit que le cinquième 14

Quatrième segment abdominal plus large que le cinquième .... *Acmaeodera* (p. 32)

14. Sillons du premier segment thoracique pâles, plaques non blanchâtre opaque .... *Chrysophana* (p. 28)

Sillons du premier segment thoracique brun foncé, plaques blanchâtres opaques .... *Ptosima* (p. 30)

15. Plaque dorsale avec deux lignes brunes, modérément séparées et convergentes antérieurement .... *Eupristocerus* (p. 218)

Plaque dorsale avec une ligne médiane .... *Agrilus* (p. 220)

16. Premier segment thoracique aussi large ou un peu plus large que les segments suivants, corps un peu cunéiforme, de plus en plus étroit jusqu'au 12e segment .... *Brachys* (p. 304)

Premier segment thoracique plus étroit que les segments suivants; corps fusiforme, plus étroit à l'extrémité postérieure .... *Pachyschelus* (p. 298)

Collecting techniques

The tips on collecting Coleoptera given by Martin (1977) apply, in most instances, to Buprestidae; however, because of their unique habitat and habits a few specific details should be noted. Wellso et al. (1976) mention the following techniques that are especially productive:

1. Rearing specimens from infested wood yields the most valuable data. Information on adult behavior, host preferences, and so forth, can only be obtained by careful rearing of specimens. Rearing techniques are discussed by Martin (1977).

2. Collecting specimens when temperatures are above 20°C is most productive, and collecting on sunny days is often better than on cloudy days.

3. More specimens are usually found on foliage on the edge of woods than in the interior.

4. Trees and shrubs that are injured should be carefully examined. These are attractive oviposition sites, and beetles often rest on or near an injured plant. Check areas such as wood piles, tree stumps, and slash piles, because adults often rest on or near them.

Methods

All species known or suspected to occur in Canada are included. Each species is briefly described, and special mention is made of the most obvious or easily observed characters. In the hosts section, all host plants, whether they occur in Canada or not, are usually listed. Host names follow Little,

E. L., Check list of native and naturalized trees of the United States (including Alaska). U.S. Department of Agriculture Handbook No. 41, 1953, or Scoggan, H. J., The Flora of Canada, National Museum of Natural Science, Publications in Botany No. 7, 1979.

Most of the structures used in the keys and descriptions can be observed at magnifications of 50X, or less. Occasionally, higher magnifications are required. A good light source is required.

All measurements and descriptions were taken from dried specimens mounted on pins or points. For instructions on mounting specimens, consult Martin (1977) (see under Equipment and methods for preserving and mounting). Measurements were taken with an ocular micrometer.

To further assist the reader, a check list of subfamilies, tribes, and genera of Canadian Buprestidae is included.

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This book could not have been completed without the cooperation and assistance of many colleagues. To all of these colleagues, I offer my sincere thanks.

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The French keys were prepared by Mrs. J. MacNamara and checked by Dr. Y. Bousquet, both of the Biosystematics Research Centre, Ottawa.

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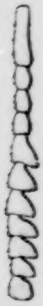
My colleagues in the Coleoptera Unit of Biosystematics Research Centre, Drs. E. C. Becker, J. M. Campbell, and A. Smetana, answered questions and assisted in a variety of ways.

Checklist of higher categories of Canadian Buprestidae

(Modified from Nelson 1981)

- Subfamily Polycestinae Lacordaire 1857:61
  - Tribe Polycestini Cobos 1955:6
    - Genus *Chrysophana* LeConte 1860:219
  - Tribe Ptosimini Kerremans 1902:37
    - Genus *Ptosima* Solier 1833:277
- Subfamily Acmaeoderinae Kerremans 1893:112
  - Tribe Acmaeoderini Kerremans 1893:112
    - Genus *Acmaeodera* Eschscholtz 1829:9
      - *Sternoxus* Billberg 1820:391
      - *Andromeda* Gistel 1834:10
    - Genus *Anambodera* Barr 1974:9
- Subfamily Chalcophorinae Lacordaire 1857:14
  - Tribe Chalcophorini Lacordaire 1857:14
    - Genus *Chalcophora* Solier 1833:278
    - Genus *Texania* Casey 1909:84
      - *Chalcophorella*: of authors, not Kerremans
- Subfamily Buprestinae Lacordaire 1857:33
  - Tribe Dicercini Kerremans 1893:107
    - Genus *Spectralia* Casey 1909:175
      - *Cinyra*: of authors, not Gory and Laporte
    - Genus *Dicerca* Eschscholtz 1829:9
      - *Argante* Gistel 1834:10
      - *Stenuris* Kirby 1837:154
    - Genus *Poecilonota* Eschscholtz 1829:9
      - *Castalia* Laporte and Gory 1841:1
      - *Latipalpis* Solier 1833:287
  - Tribe Buprestini Lacordaire 1857:33
    - Genus *Trachykele* Marseul 1865:149
    - Genus *Buprestis* Linnaeus 1758:408
      - Subgenus *Buprestis*
        - *Ancylochira* Eschscholtz 1829:9
        - *Anoplis* Kirby 1837:151
        - *Gymnota* Gistel 1834:10
      - Subgenus *Sterosa* Casey 1909:126
      - Subgenus *Cypriacis* Casey 1909:116
  - Tribe Melanophilini Bedel 1921:171
    - Genus *Melanophila* Eschscholtz 1829:9
      - Subgenus *Melanophila*
        - *Apatura* Laporte and Gory 1837:1

                - *Diana* Gory and Laporte 1841:155
                - *Trachypteris* Kirby 1837:158
                - *Oxypteris* Kirby 1837:160
            - Subgenus *Phaenops* Dejean 1836:89
    - Tribe Anthaxiini Laporte and Gory 1837:1
        - Genus *Xenorhipis* LeConte 1866:384
        - Genus *Anthaxia* Eschscholtz 1829:9
        - Genus *Haplanthaxia* Reitter 1911:187
        - Genus *Agrilaxia* Kerremans 1903:177
- Subfamily Chrysobothrinae Laporte and Gory 1837:1
    - Tribe Chrysobothrini Laporte and Gory 1837:1
        - Genus *Chrysobothris* Eschscholtz 1829:9
            - *Amblis* Gistel 1834:10
            - *Enocys* Gistel 1856:415
            - *Knowltonia* Fisher 1935:117
            - *Odontomus* Kirby 1837:156
        - Genus *Actenodes* Lacordaire 1857:72
- Subfamily Agrilinae Laporte and Gory 1837:1
    - Tribe Coraebini Bedel 1921:170
        - Genus *Eupristocerus* Deyrolle 1864:11
            - *Coraebus*: of authors, not Laporte and Gory
    - Tribe Agrilini Laporte and Gory 1837:1
        - Genus *Agrilus* Curtis 1825:67
            - *Teres* Harris 1829:2
            - *Anambus* Thompson 1864:38
            - *Diplolophotus* Abeille de Perrin 1897:2
            - *Paradomorphus* Waterhouse 1887:183
            - *Engyaulus* Waterhouse 1889:50
            - *Uragrilus* Semenov 1935:276
- Subfamily Trachyinae Laporte and Gory 1841:1
    - Tribe Pachyschelini Boving and Craighead 1931:49
        - Genus *Pachyschelus* Solier 1833:313
    - Tribe Brachyini Cobos 1979:424
        - Genus *Brachys* Solier 1833:312
        - Genus *Taphrocerus* Solier 1833:314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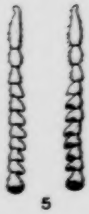
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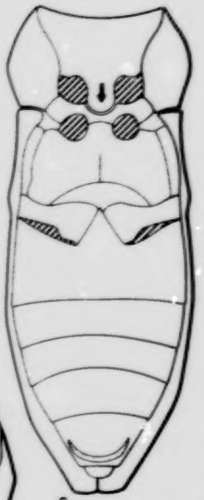
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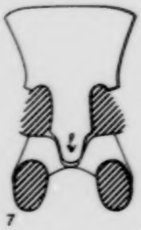
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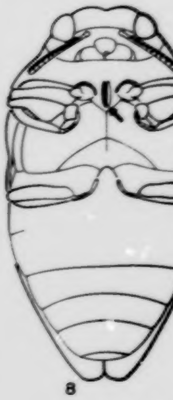
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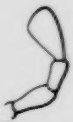
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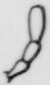
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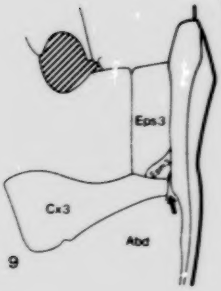
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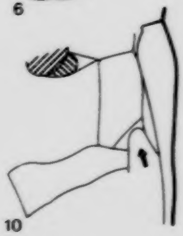
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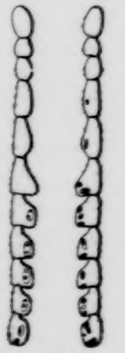
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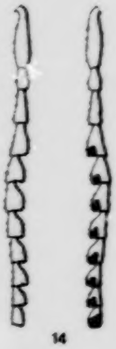
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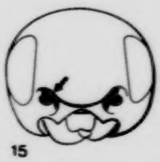
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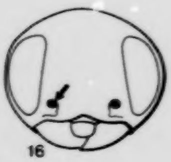
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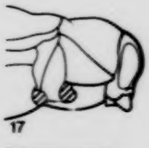
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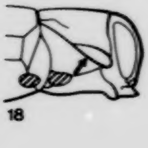
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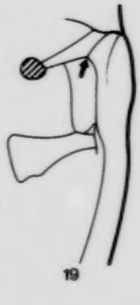
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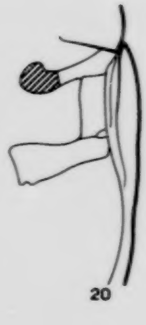
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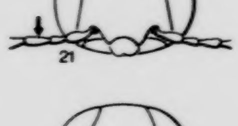
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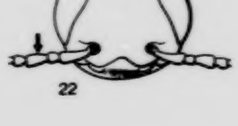
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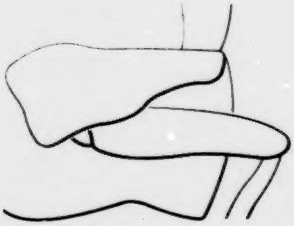
Figs. 4–22. Structures of Buprestidae (redrawn from Nelson 1981). 4, Antenna of *Acmaeodera* sp., same both surfaces; 5, Antenna of *Ptosima gibbicollis*, left: dorsal, right: ventral; 6, Ventral surface of *Thrincopyge ambiens* (LeConte) (not in Canada), illustrating sternal cavity for prosternal process; 7, Prosternal, mesosternal, and metasternal areas of male *Chalcophora* sp., illustrating sternal cavity for prosternal process; 8, Ventral surface of *Brachys* sp.; 9, *Chalcophora* sp., ventral, Eps 3 = metepisternum, Epm 3 = metepimeron, Cx3 = metacoxa, Abd = abdomen; 10, *Melanophila acuminata*, ventral, same structures as 9; 11, Maxillary palpus of *Dicerca* sp.; 12, Maxillary palpus of *Buprestis maculativentris*; 13, Antenna of species of Chalcophorinae, dorsal; 14, Antenna of species of Buprestinae, dorsal; 15, Head of female *Dicerca* sp.; 16, Head of female *Buprestis maculativentris*; 17, *Eupristocerus cognitans*, lateral; 18, *Agrilus* sp., lateral; 19, Metasternal area of male *Dicerca hesperoborealis*; 20, Metasternal area of *Buprestis maculativentris*; 21, Head of *Melanophila acuminata*; 22, Head of *Chrysobothris* sp.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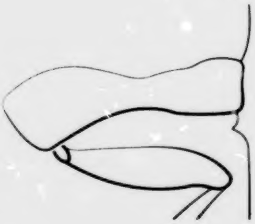
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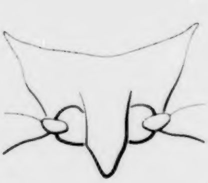
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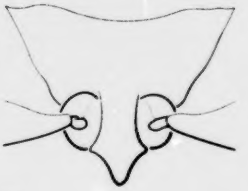
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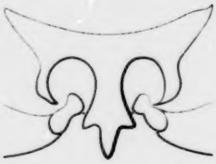
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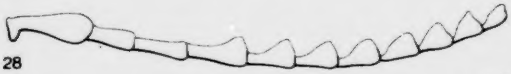
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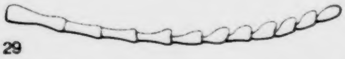
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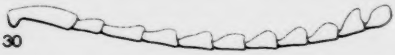
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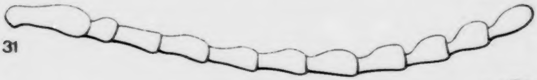
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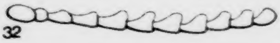
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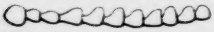
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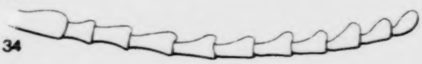
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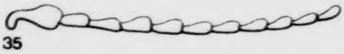
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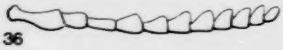
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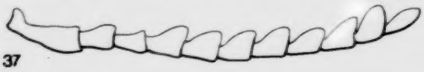
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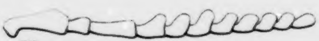
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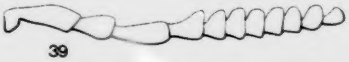
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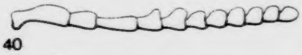
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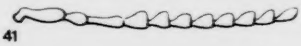
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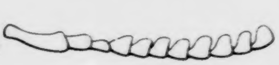
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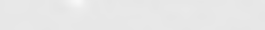
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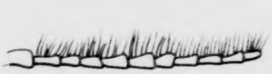
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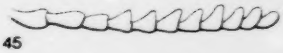
Figs. 23–44. Structures of Buprestidae (23–27 redrawn from Arnett 1960; 32, 33, 44 redrawn from Knull 1925). 23, Hind coxal plate of *Chalcophora virginiensis*; 24, Hind coxal plate of *Acmaeodera* sp.; 25, Prosternum of *Buprestis adjecta*; 26, Prosternum of *Chalcophora virginiensis*; 27, Prosternum of *Chrysobothris trinervia*; 28–44, Antennae; 28, *Trachykele blondeli*; 29, *Spectralia gracilipes*; 30, *Buprestis maculativentris*; 31, *Chalcophora liberta*; 32, *Dicerca tenebrosa*; 33, *D. callosa*; 34, *Poecilonota cyanipes*; 35, *Melanophila acuminata*; 36, *Anthaxia aeneogaster*; 37, *Haplanthaxia deleta*; 38, *Chrysobothris leechi*; 39, *Actenodes acornis*; 40, *A. simi*; 41, *Chrysophana placida*; 42, *Ptosoma gibbicollis*; 43, *Acmaeodera pulchella*; 44, *Agrilus crinicornis* ♂.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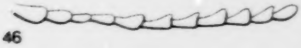
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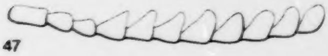
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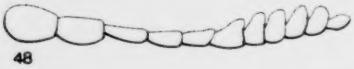
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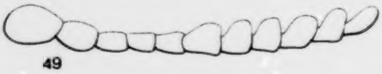
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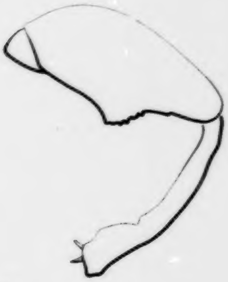
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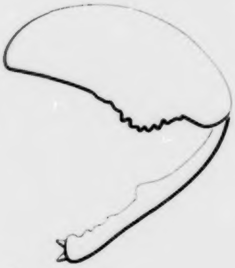
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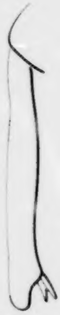
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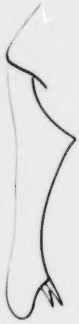
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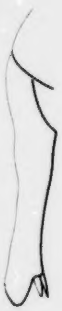
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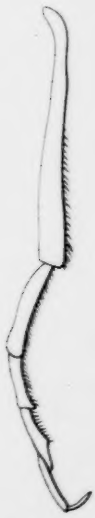
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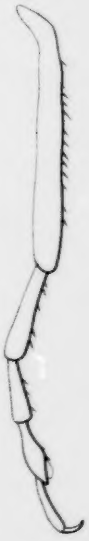
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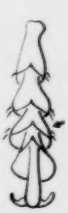
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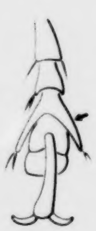
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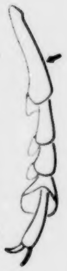
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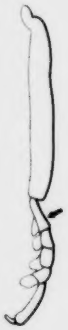
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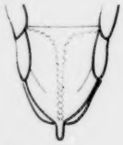
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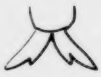
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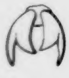
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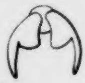
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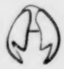
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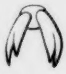
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Figs. 45–66. Structures of Buprestidae (52–54 redrawn from Nelson 1975). 45–49, Antennae; 45, *Agrilus politus*; 46, *A. egenus*; 47, *Eupristocerus cognitans*; 48, *Taphrocerus schaefferi*; 49, *Brachys aerosus*; 50, Coxa and tibia of *Chrysobothris leechi*; 51, Coxa and tibia of *C. femorata*; 52, Mesotibia of *Dicerca sexualis*; 53, Mesotibia of *D. tenebrica* ♂; 54, Mesotibia of *D. tenebrosa* ♂, 55, Tibia and tarsus of *Melanophila acuminata*; 56, Tibia and tarsus of *M. fulvoguttata*; 57, Tarsus of *Chrysobothris leechi*; 58, Tarsus of *Actenodes simi*; 59, Tarsus of *Agrilus bilineatus bilineatus*; 60, Tibia and tarsus of *Eupristocerus cognitans*; 61, Pygidium of *Agrilus bilineatus bilineatus*; 62, Tarsal claws of *Acmaeodera pulchella*; 63–66, Tarsal claws of *Agrilus*; 63, *A. ruficollis*; 64, *A. cephalicus*; 65, *A. lecontei*; 66, *A. bilineatus bilineatus*.

Key to subfamilies, tribes, and genera of Buprestidae of Canada and Alaska

(Modified from Nelson 1981)

1. Sternal cavity for reception of prosternal process formed entirely by mesosternum (Fig. 6) 2

Sternal cavity for reception of prosternal process attained or formed in part by metasternum (Fig. 7) 5

2. Antennal segments 5–11 with sensory pores in part concentrated in fossae on either dorsal or ventral surface or on both surfaces, at least in apical segments (Fig. 5) (subfamily Polycestinae) 3

Antennal segments 5–11 with sensory pores diffuse, without vestiges of fossae or depressions on either dorsal or ventral surface (Fig. 4) (subfamily Acmaeoderinae, tribe Acmaeoderini) 4

3. Claws simple, slightly swollen at base; base of pronotum without row of rasplike grooves (Fig. 67); body bluish or greenish, with a reddish or coppery longitudinal stripe on each elytron; western species (tribe Polycestini) ... . ***Chrysophana* LeConte** (p. 28)

Claws with a broad basal tooth (Fig. 62); base of pronotum with a row of rasplike grooves; body dark brown to black, with distinct reddish or yellowish patches on lateral areas of each elytron (Fig. 69); eastern species (tribe Ptosimini) .... ***Ptosima* Solier** (p. 30)

4. Front margin of epistoma narrowly reflexed or platelike in front of each antennal base, projecting over mandibular base; sides of pronotum margined or reflexed; suture between first and second abdominal sternites not visible .... ***Acmaeodera* Eschscholtz** (p. 32)

Front margin of epistoma not narrowly reflexed or platelike in front of each antennal base, not projecting over mandibular base; sides of pronotum not margined or reflexed; suture between first and second abdominal sternites visible .... ***Anambodera* Barr** (p. 39)

5. Sternal cavity for reception of prosternal process formed laterally by mesosternum, apically by metasternum; mesosternum normally developed (Fig. 7); hind coxal plates distinctly dilated internally, with anterior margins more or less straight (Fig. 23) 6

Sternal cavity for reception of prosternal process formed almost entirely by metasternum; mesosternum reduced in size, short (Fig. 8); hind coxal plates dilated internally or not, but only slightly longer internally than externally, with anterior margins usually sinuate (Fig. 24) 19

6. Anterolateral projection of abdomen narrow, not covering metepimeron (Fig. 9) 7

Anterolateral projection of abdomen broader, partially covering metepimeron (Fig. 10) 13

7. Antennal pores diffuse on both surfaces of segments 6–11, or along outer border, especially on ventral surface, or sometimes condensed in a depression or multiple foveae along this border an apical depression (Fig. 13); pronoto-elytral articulation overlapping in middle, usually not so on lateral outer border where they abut simply (subfamily Chalcophorinae) 8

Antennal pores mainly concentrated in well-defined fovea, apical or ventral, on each lobed segment (Fig. 14); pronoto-elytral articulation usually overlapping to lateral border (subfamily Buprestinae, in part) 9

8. Apical third of elytral margins entire or finely serrate; pronotal disc unisulcate (Fig. 80) .... **_Chalcophora_ Solier** (p. 41)

Apical third of elytral margins strongly serrate; pronotal disc bisulcate .... **_Texania_ Casey** (p. 47)

9. Antennal cavities large, usually deep and bordered above by a well-developed ridge (Fig. 15); last segment of maxillary palpus enlarged, triangular or oval (Fig. 11); epipleuron angulate at junction of mesepimeron and metepisternum (Fig. 19); dorsal surface commonly bearing raised callosities; prosternal process distinctly widened behind procoxae (except *Spectralia*) (Figs. 26, 27) (tribe Dicercini) 10

Antennal cavities small, usually shallow (Fig. 16); last segment of maxillary palpus cylindrical or slightly expanded apically (Fig. 12); epipleuron not angulate at junction of mesepimeron and metepisternum (Fig. 20); dorsal surface smooth or costate, usually without raised callosities; prosternal process not widened behind procoxae (Fig. 25) (tribe Buprestini) 12

10. Prosternal process distinctly widened behind procoxae (Figs. 26, 27); elytral apices prolonged or extending beyond apex of abdomen 11

Prosternal process not widened behind procoxae (Fig. 25); elytral apices not prolonged nor extending beyond apex of abdomen .... **_Spectralia_ Casey** (p. 49)

11. Scutellum circular; pronotum longitudinally sulcate at middle (Figs. 100–118) .... **_Dicerca_ Eschscholtz** (p. 51)

Scutellum broader than long; pronotum with a median longitudinal ridge or smooth line (Fig. 124) .... **_Poecilonota_ Eschscholtz** (p. 79)

12. Scutellum not visible; pronotum with 3 small, deep pits along basal margin (Figs. 125, 126) .... **_Trachykele_ Marseul** (p. 89)

Scutellum visible; pronotum without deep pits along basal margin (frontispiece) .... **_Buprestis_ Linnaeus** (p. 94)

13. Eyes weakly convergent on vertex (Fig. 21); third antennal segment at most slightly longer than fourth (Fig. 21) (subfamily Buprestinae, in part) 14

Eyes strongly convergent on vertex (Fig. 22); third antennal segment 1.5–4.0 times longer than fourth (Fig. 22) (subfamily Chrysobothrinae) 18

14. Base of pronotum sinuate (Figs. 155, 156); punctation of disc not reticulated; elytra frequently maculate (tribe Melanophilini) .... **_Melanophila_ Eschscholtz** (p. 124)

Base of pronotum subrectangularly extended medially; punctation of disc reticulated, at least laterally; elytra not maculate (tribe Anthaxiini) .. 15

15. Male antennae pectinate, with extremely long projections on each segment; each elytron with a large, pale spot on base, spot extending nearly one-third length of elytra .... **_Xenorhipis_ LeConte** (p. 139)

Male antennae not pectinate, similar to that of female; each elytron not ornamented as above 16

16. Elytra not constricted at middle, clothed with short, stiff setae; abdomen not visible from above; body stout, broad (Figs. 163-166) .... ***Anthaxia*** **Eschscholtz** (p. 140)

Elytra conspicuously constricted at middle, glabrous; abdomen visible from above (Figs. 175-178); body slender 17

17. Body slender, elytra about 2.1 times longer than wide; head broadly impressed at middle (Figs. 175-177) .... ***Haplanthaxia*** **Reitter** (p. 150)

Body very slender, elytra 2.9-3.0 times longer than wide; head evenly convex, not impressed at middle (Fig. 178) .... ***Agrilaxia*** **Kerremans** (p. 160)

18. Third tarsal segment truncate; first segment of hind tarsi elongate (Fig. 57) .... ***Chrysobothris*** **Eschscholtz** (p. 162)

Third tarsal segment prolonged laterally; first and second segment of hind tarsi subequal (Fig. 58) .... ***Actenodes*** **Lacordaire** (p. 216)

19. Body usually narrowly elongate (Fig. 257); mesocoxae not appreciably more separated than procoxae; anterior margin of metacoxae noticeably sinuate (Fig. 24); tarsi elongate (Figs. 59, 60) (subfamily Agrilinae) 20

Body usually triangular or oval (Figs. 262-264); mesocoxae appreciably more separated than procoxae; anterior margin of metacoxae slightly sinuate; tarsi short (subfamily Trachyinae) 21

20. Pronotum without submarginal carina (Fig. 17); first segment of hind tarsus as long as or only slightly longer than each of the three following segments (Fig. 60); head deeply, longitudinally impressed; sides of pronotum weakly serrate (tribe Coraebini) .... ***Eupristocerus*** **Deyrolle** (p. 218)

Pronotum with submarginal carina (Fig. 18); first segment of hind tarsus much longer than each of the three following segments (Fig. 59); head convex, weakly longitudinally impressed; sides of pronotum entire (tribe Agrilini) .... ***Agrilus*** **Curtis** (p. 220)

21. Base of pronotum subrectangularly extended medially, excavated laterally to receive elytral bases; scutellum small (Figs. 263, 264) (tribe Brachyini) 22

Base of pronotum forming an almost straight to sinuate line across body; scutellum large, triangular (Fig. 262) (tribe Pachyschelini) .... ***Pachyschelus*** **Solier** (p. 298)

22. Prosternal process grooved; body broad, ovate, less than 2.0 times longer than wide; elytra with a sublateral carina extending from humerous to near apex (Fig. 263) .... ***Brachys*** **Solier** (p. 304)

Prosternal process not grooved; body narrow, elongate, at least 2.4 times longer than wide; elytra without a sublateral carina (Fig. 264) .... ***Taphrocerus*** **Solier** (p. 309)

Tableau des sous-familles, tribus et genres de Buprestides du Canada et de l'Alaska

(modifiée de Nelson 1981)

1. **Cavité sternale, recevant la saillie prosternale, formée entièrement par le mésosternum (fig. 6) 2**

Cavité sternale, recevant la saillie prosternale formée en partie par le métasternum ou l'atteignant (fig. 7) 5

2. **Articles antennaires 5-11 avec des pores sensoriels, en partie concentrés dans des fosses, sur la surface dorsale ou ventrale ou sur les deux surfaces du moins sur les segments apicaux (fig. 5) (sous-famille Polycestinae) 3**

Articles antennaires 5–11 avec pores sensoriels diffus, sans trace de fosses ou dépressions sur la surface dorsale ou ventrale (fig. 4) (sous-famille Acmaeoderinae, tribu Acmaeoderini) 4

3. Griffes simples, un peu enflées à la base; base du pronotum sans rangée de sillons râpés (fig. 67); corps bleuâtre ou verdâtre, avec une bande longitudinale rougeâtre ou cuivrée sur chaque élytre; espèces de l'Ouest (tribu Polycestini) .... ***Chrysophana* LeConte** (p. 28)

Griffes avec une large dent basale (fig. 62); base du pronotum avec une rangée de sillons râpés; corps brun foncé à noir, avec des taches rougeâtres ou jaunâtres distinctes sur la partie latérale de chaque élytre (fig. 69); espèces de l'Est (tribu Ptosimini) .... ***Ptosima* Solier** (p. 30)

4. Marge antérieure de l'épistome étroitement retroussée ou en forme de plaque en avant de la base de chaque antenne, projetée au-dessus de la base des mandibules; côtés du pronotum marginés ou retroussés; suture entre les premier et deuxième sternites abdominaux non visible .... ***Acmaeodera* Eschscholtz** (p. 32)

Marge antérieure de l'épistome non retroussée ni en forme de plaque en avant de la base de chaque antenne, non projetée au-dessus de la base des mandibules; côtés du pronotum non marginés ni retroussés; suture visible entre les premier et deuxième sternites abdominaux .... ***Anambodera* Barr** (p. 39)

5. Cavité sternale recevant la saillie prosternale formée latéralement par le mésosternum, postérieurement par le métasternum; mésosternum normalement développé (fig. 7); plaques coxales postérieures distinctement dilatées du côté interne, avec les marges antérieures plus ou moins droites (fig. 23) ... 6

Cavité sternale recevant la saillie prosternale formée presque entièrement par le métasternum; mésosternum réduit, court (fig. 8); plaques coxales postérieures dilatées ou non du côté interne, mais légèrement plus longues du côté interne que du côté externe avec les marges antérieures généralement sinueuses (fig. 24) 19

6. Projection antérolatérale de l'abdomen étroite, ne recouvrant pas le métépimère (fig. 9) 7

Projection antérolatérale de l'abdomen plus large, recouvrant en partie le métépinère (fig. 10) 13

7. Pores antennaires diffus sur les deux surfaces des articles 6–11, ou le long du bord externe, surtout sur la surface ventrale, ou parfois condensés dans une dépression ou des fosses multiples le long de ce bord, et occasionnellement avec une dépression apicale (fig. 13); articulation pronoto-élytrale se recouvrant au centre, mais généralement pas sur le bord externe (sous-famille Chalcophorinae) 8

Pores antennaires surtout concentrés dans des fosses bien délimitées, apicales ou ventrales, sur chaque article lobé (fig. 14); articulation pronoto-élytrale se recouvrant généralement jusqu'au bord externe (sous-famille Buprestinae, en partie) 9

8. Marges des élytres, sur le tiers apical, entières ou finement dentées; disque du pronotum avec un sillon (fig. 80) .... ***Chalcophora* Solier** (p. 41)

Marges des élytres, sur le tiers apical, fortement dentées; disque du pronotum avec deux sillons .... ***Texania* Casey** (p. 47)

9. Cavités antennaires larges, généralement profondes et bordées au-dessus par une carène bien développée (fig. 15); dernier article du palpe maxillaire élargi, triangulaire ou oval (fig. 11); épipleure angulaire à la jonction du mésépimère et du métépisternum (fig. 19); surface dorsale généralement avec des callosités soulevées; saillie prosternale distinctement élargie en arrière des procoxae (sauf *Spectralia*) (fig. 26, 27) (tribu Dicercini) 10

Cavités antennaires petites, généralement peu profondes (fig. 16); dernier article du palpe maxillaire cylindrique ou un peu élargi à l'apex (fig. 12); épipleure non angulaire à la jonction du mésépimère et du métépisternum (fig. 20); surface dorsale lisse ou avec des costae, généralement sans callosités soulevées; saillie prosternale non élargie en arrière des procoxae (fig. 25) (tribu Buprestini) 12

10. Saillie prosternale distinctement élargie en arrière des procoxae (fig. 26, 27); apex de chaque élytre prolongé ou dépassant l'extrémité de l'abdomen 11

Saillie prosternale non élargie en arrière des procoxae (fig. 25); apex de chaque élytre non prolongé et ne dépassant pas l'extrémité de l'abdomen .... ***Spectralia*** **Casey** (p. 49)

11. Scutellum circulaire; pronotum avec un sillon longitudinal au milieu (fig. 100–118) .... ***Dicerca*** **Eschscholtz** (p. 51)

Scutellum plus large que long; pronotum avec une carène longitudinale médiane ou une ligne lisse (fig. 124) .... ***Poecilonota*** **Eschscholtz** (p. 79)

12. Scutellum non visible; pronotum avec trois petites fossettes profondes le long de la marge basale (fig. 125, 126) .... ***Trachykele*** **Marseul** (p. 89)

Scutellum visible; pronotum sans fossettes profondes le long de la marge basale (frontispice) .... ***Buprestis*** **Linnaeus** (p. 94)

13. Yeux faiblement convergents sur le vertex (fig. 21); troisième article antennaire à peine plus long que le quatrième (fig. 21) (sous-famille Buprestinae, en partie) 14

Yeux fortement convergents sur le vertex (fig. 22); troisième article antennaire 1,5–4,0 fois plus long que le quatrième (fig. 22) (sous-famille Chrysobothrinae) 18

14. Base du pronotum sinueuse (fig. 155, 156); ponctuation sur le disque non réticulée; élytres fréquemment maculés (tribu Mélanophilini) .... ***Melanophila*** **Eschscholtz** (p. 124)

Base du pronotum prolongée au milieu de manière rectangulaire; ponctuation sur le disque réticulée, au moins latéralement; élytres non maculés (tribu Anthaxiini) 15

15. Antennes du mâle pectinées, avec des projections extrêmement longues sur chaque article; chaque élytre avec une large tache pâle à la base s'étendant sur presque le tiers de la longueur de l'élytre .... ***Xenorhipis*** **LeConte** (p. 139)

Antennes du mâle non pectinées, semblables à celles de la femelle; élytres différemment décorés 16

16. Élytres non rétrécis au milieu, couverts de courtes soies raides; abdomen non visible d'au-dessus; corps robuste, large (fig. 163–166) .... ***Anthaxia*** **Eschscholtz** (p. 140)

Élytres distinctement rétrécis au milieu, glabres; abdomen visible d'au-dessus (fig. 175–178); corps étroit 17

17. Corps étroit, élytres environ 2,1 fois plus longs que larges; tête avec une large impression au milieu (fig. 175–177) ...... ***Haplanthaxia*** **Reitter** (p. 150)

Corps très étroit, élytres 2,9–3,0 fois plus longs que larges; tête convexe, sans impression au milieu (fig. 178) .... ***Agrilaxia*** **Kerremans** (p. 160)

18. Troisième article des tarses tronqué; premier article du tarse postérieur allongé (fig. 57) .... ***Chrysobothris*** **Eschscholtz** (p. 162)

Troisième article des tarses prolongé latéralement; premier et deuxième articles du tarse postérieur de longueur égale (fig. 58) .... ***Actenodes*** **Lacordaire** (p. 216)

19. Corps en général étroitement allongé (fig. 257); mésocoxae non distinctement plus séparés que les procoxae; marge antérieure des métacoxae distinctement sinueuse (fig. 24); tarses allongés (fig. 59, 60) (sous-famille Agrilinae) 20

Corps généralement triangulaire ou ovale (fig. 262–264); mésocoxae distinctement plus séparés que les procoxae; marge antérieure des métacoxae légèrement sinueuse; tarses courts (sous-famille Trachyinae) 21

20. Pronotum sans carène submarginale (fig. 17); premier article du tarse postérieure aussi long ou légèrement plus long que chacun des trois articles suivants (fig. 60); tête avec une profonde impression longitudinale; côtés du pronotum faiblement dentelés (tribu Coraebini) ... ***Eupristocerus* Deyrolle** (p. 218)

Pronotum avec une carène submarginale (fig. 18); premier article du tarse postérieur bien plus long que chacun des trois articles suivants (fig. 59); tête convexe, avec une faible impression longitudinale; côtés du pronotum entiers (tribu Agrilini) .... ***Agrilus* Curtis** (p. 220)

21. Base du pronotum prolongée au milieu de manière rectangulaire, excavée latéralement pour recevoir la base des élytres; scutellum petit (fig. 263, 264) (tribu Brachyini) 22

Base du pronotum formant une ligne presque droite à sinueuse en travers du corps; scutellum large, triangulaire (fig. 262) (tribu Pachyschelini) .... ***Pachyschelus* Solier** (p. 298)

22. Saillie prosternale avec des sillons; corps large, ovoïde, moins de 2,0 fois plus long que large; élytres avec une carène sublatérale s'étendant de l'épaule jusque près de l'apex (fig. 263) .... ***Brachys* Solier** (p. 304)

Saillie prosternale sans sillons; corps étroit, allongé, au moins 2,4 fois plus long que large; élytres sans carène sublatérale (fig. 264) .... ***Taphrocerus* Solier** (p. 309)

Genus *Chrysophana* LeConte

This genus contains two species, only one of which occurs in Canada. Both species occur in cones, stumps, trunks, or limbs of coniferous hosts.

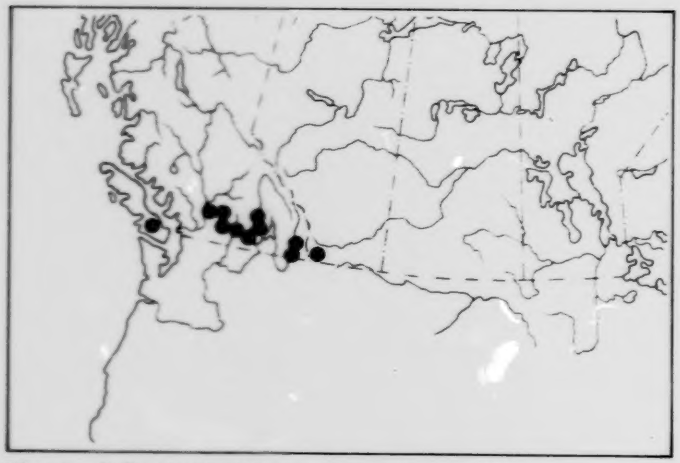
Description. Head convex, weakly flattened or narrowly impressed between antennal bases; epistoma broadly, very shallowly arcuate. Antennae short, serrate from fourth segment (Fig. 41). Eyes large, elliptic, inner margins parallel. Pronotum wider than long; base weakly sinuate; anterior margin evenly arcuate; surface strongly punctured. Scutellum visible, very small, oblong. Elytra slightly expanded on posterior half, apex broadly rounded, surface randomly, densely punctured. Prosternum convex, anterior margin truncate, lateral margin not expanded behind procoxae. Legs slender; protibiae carinate, slightly expanded apically; tarsal claws simple.

Comments. Two species are listed and keyed in Barr (1971). Often in catalogs, *conicola* Van Duzee is listed as a variety or a synonym of *placida* (LeConte). I am following the treatment of Barr (1971) and considering both forms as species. As far as is known, only *placida* occurs in Canada.

Chrysophana placida (LeConte)

Figs. 41, 67; Map 1

Ancylochira placida LeConte, 1854:17.
Chrysophana placida: Chamberlin 1926:177; Barr 1971:82.



Map 1. Collection localities of *Chrysophana placida*.

Description. Head brilliantly green or blue with yellowish tinge; pronotum same color as head, with yellowish, coppery, or somewhat darker median reflection on anterior margin; elytra brilliantly bluish or greenish, with broad, longitudinal, coppery, yellowish, or reddish stripe on each elytron; ventrally uniformly bright green. Head densely, deeply punctured, punctures close, almost touching, very large, deeply impressed, glabrous. Antennae black, dark purple, or dark blue. Pronotum 1.4 times wider than long, widest behind middle; sides diverging on anterior two-thirds, then arcuately converging to base; disc convex, densely, deeply punctured, punctures of moderate size. Elytra about 1.9–2.0 times longer than wide; sides weakly constricted on anterior half, slightly expanded, then converging to broadly rounded apex; disc densely, randomly punctured, with a slight indication of striae, punctures moderate in size, very close. Ventral surface finely, densely punctured. Length 6.0–10.5 mm.

Hosts. Occurs in most conifers in its range, including lodgepole pine (*Pinus contorta*), ponderosa pine (*P. ponderosa*), limber pine (*P. flexilis*), western white pine (*P. monticola*), Jeffrey pine (*P. jeffreyi*), singleleaf pinyon pine (*P. monophylla*), knobcone pine (*Pinus attenuata*), mountain hemlock (*Tsuga mertensiana*), alpine fir (*Abies lasiocarpa*), white fir (*A. concolor*), red fir (*A. magnifica*), Douglas-fir (*Pseudotsuga menziesii*), and western red cedar (*Thuja plicata*).

Distribution. Southern British Columbia and Alberta, south through the Rocky Mountains and Pacific coast states to California, Nevada, Arizona, and New Mexico.

Comments. This species is easily recognized by the bright metallic green or blue color with a broad, reddish, longitudinal stripe on each elytron.

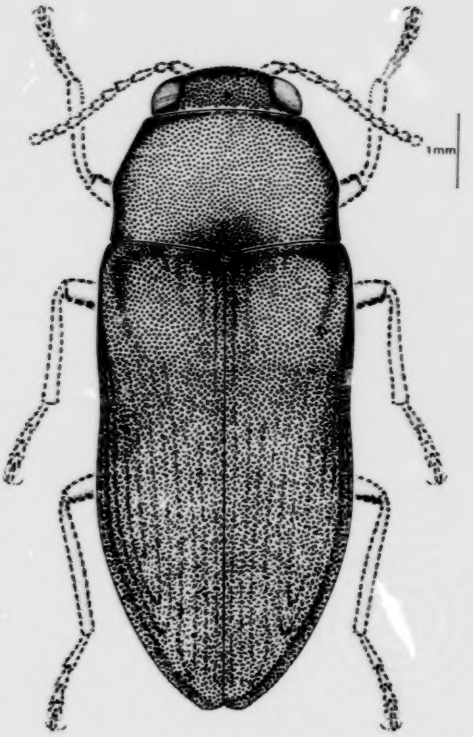


Fig. 67. *Chrysophana placida*.

The larvae of this species mine in the trunk, limbs, tops, and roots of various species of coniferous trees. It is a common but unimportant and seldom observed buprestid.

Genus *Ptosima* Solier

This genus contains about 15 species throughout the world, four of which occur in North America, north of Mexico. Only one species may occur in Canada.

Little is known of the biology or life history of any species in this genus. Nelson et al. (1981) state that the larvae pupate and transform to adults in the fall. The adults overwinter in the pupal cell and emerge in the spring. Adults are most commonly collected from March to May.

Description. Head moderately convex, flattened or weakly impressed between antennal insertions; epistoma broadly, moderately deeply arcuate. Antennae short, serrate from fourth segment (Fig. 42). Eyes large, oval, inner margins parallel. Pronotum wider than long, flattened medially; base truncate; anterior margin evenly arcuate; surface finely punctured, more strongly punctured laterally. Scutellum visible, oval or round. Elytra with sides parallel on basal three-fourths, basal margin elevated, apex narrowly rounded; lateral margins serrate on apical one-fourth; surface finely, randomly punctured. Prosternum convex, anterior margin truncate, lateral margin not expanded behind procoxae. Legs slender, tibiae not carinate; tarsal claws with broad, basal tooth.

Comments. Nelson (1978) reviewed the North American species in this genus.

Ptosima gibbicollis (Say)

Figs. 42, 69

Buprestis gibbicollis Say, 1839:161.

Ptosima gibbicollis: Knull 1925:7; Chamberlin 1926:234; Craighead 1950:196; Wellso et al. 1976:13; Nelson 1978:332.

Description. Head and pronotum bright shining black and with fine, silvery pubescence; elytra dark brown to black, with large, elongate patch of yellow on lateral area on basal half and with transverse band of yellow before apex extending from lateral margin to suture, pubescence short, erect, silvery. Head finely, densely punctured, punctures rather small and shallow, somewhat larger on vertex, pubescence abundant. Antennae black with long, silvery pubescence. Pronotum about 1.3 times wider than long, widest near middle; sides weakly arcuate, more strongly converging anteriorly; disc flattened, densely punctate except on narrow, median line, punctures large, deep, lateral margin of flattened area more strongly punctured, strigose; pubescence abundant. Elytra about 2.3 times longer than wide; sides parallel on basal two-thirds, strongly converging to narrowly rounded apex; serrations on lateral margin acute; disc densely, randomly punctured, punctures shallow. Ventral surface black, finely punctured with abundant, long, fine, silvery setae. Length 4.7–7.5 mm.

Hosts. Reared from redbud (*Cercis canadensis*), collected on sassafrass (*Sassafras sassafras*), black locust (*Robinia pseudoacacia*), and black cherry (*Prunus seratina*).

Distribution. Known from the eastern and midwestern states, north to Michigan; probably occurs in southern Ontario.

Comments. Adults of this species are easily recognized by the color pattern.

Nothing is known of the habits or life history of this species except the host plants and the brief statement in Knull (1920) (summarized in introductory statement).

Genus *Acmaeodera* Eschscholtz

This genus contains about 130 species in North America, mostly distributed in the western and southwestern parts of the United States. The genus has not been revised since Fall's (1899) study; consequently the nomenclature and systematics of the genus are not well known.

The larvae of species in this genus bore in dead and injured branches, stems, and roots of broad-leaved trees and shrubs. Adults are frequently found on flowers.

Description. Head convex, flattened above clypeus, carinate or grooved on vertex; clypeus emarginate in front. Antennae variable in length, serrate from fifth segment, inserted on front of head (Fig. 43). Eyes large, oblong. Pronotum wider than long, convex to flattened, broadly sinuate in front; sides broadly arcuate to subparallel; base truncate; surface distinctly punctate, often with pair of subbasal pits. Scutellum not visible. Elytra elongate, truncate at base, usually without longitudinal costae, apex rounded, lateral margin serrate posteriorly. Prosternum truncate, bisinuate or trisinuate in front. Suture between first and second abdominal segments not visible; last visible abdominal sternite with or without a subapical elevation; legs slender; tarsal claws cleft (Fig. 62).

Comments. This genus was revised by Fall (1899). No recent revision of the entire genus is available. Barr (1971) treats the species occurring in the Pacific Northwest, but almost all recent literature dealing with this genus contains only descriptions of new species, notations about synonymy, or new distribution records. The genus is in dire need of a comprehensive revision of the North American fauna.

Acmaeodera quadrivittata Horn was reported from Loma, B.C., by Chamberlin (1926), but Barr (1971) states this record is based on a mislabeled or incorrectly identified specimen.

Key to species of *Acmaeodera* in Canada

1. Last visible abdominal sternite with short, distinct, acute, subapical elevation 2
   Last visible abdominal sternite without subapical elevation 3
2. Sides of pronotum subparallel on basal half; southern Alberta to Ontario .... ***pulchella* Herbst** (p. 33)
   Sides of pronotum arcuate on basal half; southern British Columbia and Alberta .... ***variegata* LeConte** (p. 35)
3. Elytra almost entirely black, with only 4–7 small yellowish or reddish spots, these mostly on lateral areas of each elytron; body size large, generally 10 mm or more long; southern British Columbia .... ***vandykei* Fall** (p. 37)
   Elytra distinctly bicolored, with up to 8 large yellowish or reddish spots, extending onto disc; body size small, generally less than 10 mm long .. 4
4. Eastern species; body size 4.5–6.5 mm; interstrial setae short, stout, about equal in length to interstrial width .... ***tubulus* (Fabricius)** (p. 38)
   Western species; body size 8–10 mm; interstrial setae long, fine, about 2.0–3.0 times longer than interstrial width .... ***idahoensis* Barr** (p. 39)

Tableau des espèces d'*Acmaeodera* du Canada

1. Dernier sternite abdominal visible avec une élévation subapicale courte, distincte, aigue 2
Dernier sternite abdominal visible sans élévation subapicale 3

2. Côtés du pronotum subparallèles sur la moitié basale; sud de l'Alberta jusqu'en Ontario .... ***pulchella* Herbst** (p. 33)
Côtés du pronotum arqués sur la moitié basale; sud de la Colombie-Britannique et Alberta .... ***variegata* LeConte** (p. 35)

3. Élytres presque entièrement noirs, avec seulement 4-7 petites taches jaunâtres ou rougeâtres situées pour la plupart sur la partie latérale de chaque élytre; corps de grande taille, généralement 10 mm, ou plus; sud de la Colombie-Britannique .... ***vandykei* Fall** (p. 37)
Élytres distinctement bicolorés, avec jusqu'à 8 grosses taches jaunâtres ou rougeâtres s'étendant sur le disque; corps de petite taille, généralement moins de 10 mm 4

4. Espèce répartie dans l'Est; longueur du corps 4,5-6,5 mm; soies des interstries courtes, grosses, à peu près de même longueur que la largeur de l'interstrie .... ***tubulus* (Fabricius)** (p. 38)
Espèce répartie dans l'Ouest; longueur du corps 8-10 mm; soies des interstries longues, fines, environ 2,0-3,0 fois plus longues que la largeur de l'interstrie .... ***idahoensis* Barr** (p. 39)

Acmaeodera pulchella (Herbst)

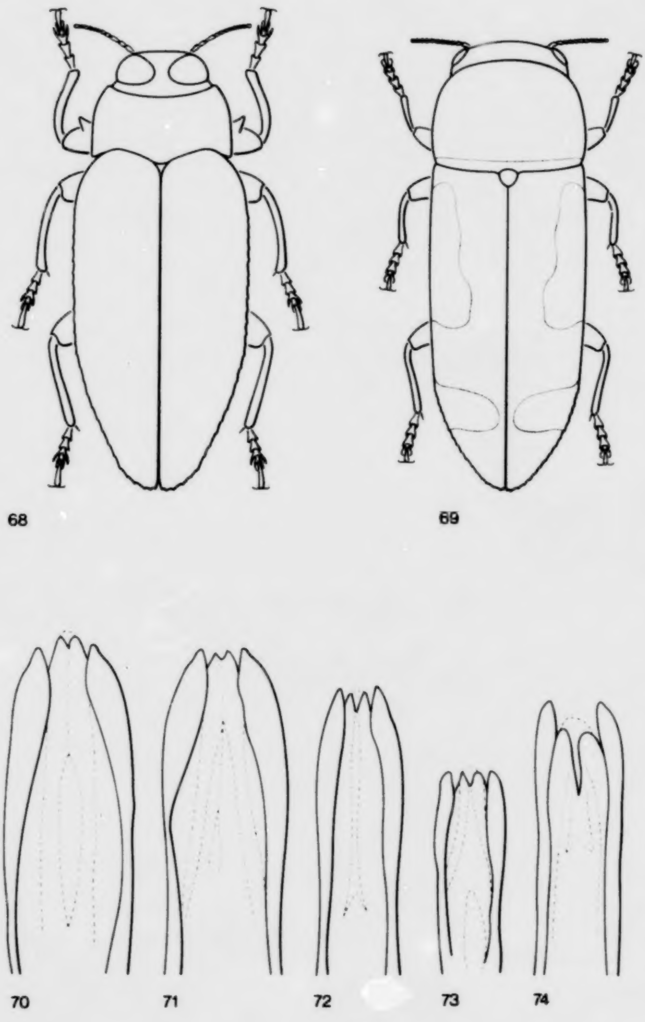
Figs. 43, 62, 70; Map 2

Buprestis pulchella Herbst, 1801:211.

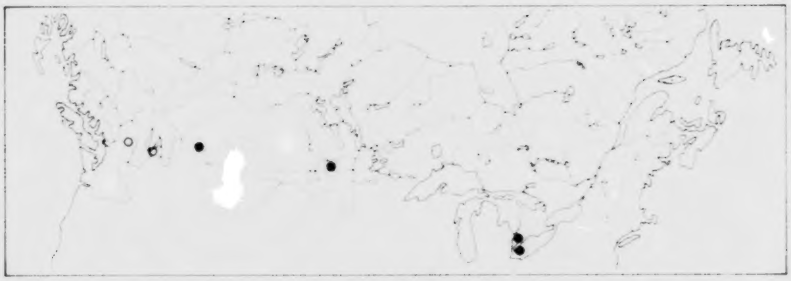
Acmaeodera pulchella: Fall 1899:29; Knull 1925:6; Chamberlin 1926:31; Craighead 1950:190; Baker 1972:160; Wellso et al. 1976:13.

Acmaeodera flavosignata Gory, 1841:30.

Description. Head black to dark brown, shining; pronotum black to dark brown, with yellowish spot of varying size laterally at each apical angle; elytra shining, with nearly equal amounts of yellow and black, yellow conspicuous laterally on basal half, extending onto disc in various configurations or as spots, also in one or two, oblique, subapical fasciae, these also may be entire or interrupted. Head with frons strongly convex with a weak, longitudinal, median impression, more obvious dorsally; surface densely punctured, punctures deep, close, and each with erect, long, brownish seta; epistoma deeply emarginate. Pronotum 2.0 times wider than long, widest on posterior half; sides strongly rounded anteriorly, nearly parallel on posterior half; disc evenly convex, with small, deep pit on each side near base; surface densely, deeply punctured, punctures very close, each with long, erect, fine, brownish hair. Elytra about 2.1 times longer than wide; sides weakly constricted on anterior fourth, then weakly expanded on median portion, arcuately converging to narrowly rounded apices, lateral margin distinctly serrate on apical third; humeral elevations prominent; surface shining; striae narrowly impressed, with large punctures arranged in even rows; interstriae convex, punctures much smaller, and with median row of abundant, long,



Figs. 68–74. 68, *Actenodes acornis*; 69, *Ptosima gibbicollis*; 70–74, Aedeagi of *Acmaeodera* spp.; 70, *A. pulchella*; 71, *A. variegata*; 72, *A. vandykei*; 73, *A. tubulus*; 74, *A. idahoensis*.



Map 2. Collection localities of *Acmaeodera pulchella* (•) and *A. vandykei* (○).

fine, erect hairs, these 3.0–4.0 times longer than interstrial width. Ventral surface finely, densely punctured, with abundant, fine, white setae; last visible abdominal sternite with a short, acute, elevated, subapical elevation. Aedeagus as in Fig. 70. Length 5.5–10 mm.

Hosts. Taken on a wide variety of herbaceous plants, e.g., redroot (*Ceanothus*), coneflower (*Rudbeckia*), milkweed (*Asclepias* spp.), and prickly-pear (*Opuntia* spp.).

Distribution. Southern Alberta to Ontario, south throughout the United States to California, Texas, and Florida.

Comments. This is a common and widespread species. Variation in surface structure is not especially noticeable except in the configurations of the color pattern. In some specimens, the dark color predominates, thus reducing the yellow color to small spots rather than distinct fasciae.

Adults of this species resemble those of *variegata* but may be distinguished by the longer elytral setae and by the slightly more extensive dark color on the elytra.

Nothing is known of the habits or life history of this species.

Acmaeodera variegata LeConte

Figs. 71, 75; Map 3

Acmaeodera variegata LeConte, 1852:67; Barr 1975:420.
Acmaeodera lucia Fall, 1901:307; Chamberlin 1926:24; Barr 1975:420.
Acmaeodera distincta Kerremans, 1902:29; Barr 1975:420.

Description. Similar to *Acmaeodera pulchella* but differs by the more arcuately, not subparallel, posterior sides of the pronotum, by the slightly more extensive yellow markings on the elytra, and by the slightly shorter pubescence. Aedeagus as in Fig. 71. Length 6.0–9.5 mm.

Hosts. Unknown. Specimens from Alberta collected on plains prickly-pear (*Opuntia polyacantha*).

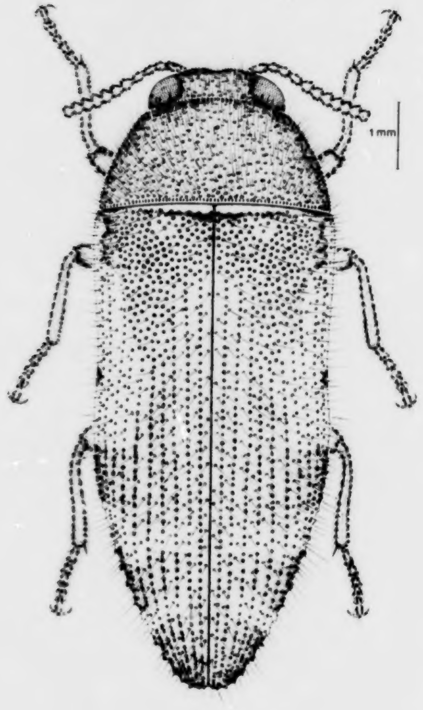
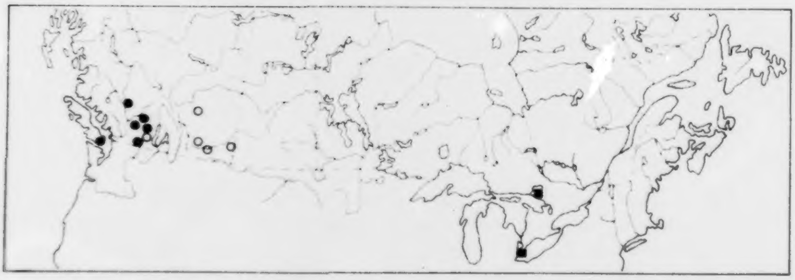


Fig. 75. *Acmaeodera variegata*.



Map 3. Collection localities of *Acmaeodera variegata* (○), *A. tubulus* (■), and *A. idahoensis* (●).

Distribution. Southern British Columbia and Alberta, south in western United States to California, New Mexico, and Colorado.

Comments. *A. variegata* is similar to *pulchella* and further studies may show the two are synonyms. Adults of *variegata* have more extensive yellow markings on the elytra and the sides of the pronotum and when viewed from above, are more strongly arcuate, not subparallel as in adults of *pulchella*. These characters may simply be variations in the populations and not indicative of specific differences.

Nothing is known of the habits or life history of this species.

Acmaeodera vandykei Fall

Fig. 72; Map 2

Acmaeodera vandykei Fall, 1899:23; Chamberlin 1926:40; Barr 1971:86.

Description. Head and pronotum black; elytra black, with about 8 small, reddish to yellowish spots, these mostly along lateral areas of elytra, spots may be combined into irregular, short bands. Head with frons strongly convex, flattened at antennal insertions, with weak, elevated carina on occiput; surface shining, densely punctured, punctures very close, moderately deep, each with long, fine, erect, brownish seta; epistoma broadly, shallowly emarginate. Pronotum 2.3-2.4 times wider than long, widest on posterior half; disc flattened in middle, deeply impressed medially at base, also with oblique impression laterally extending anteriorly from basal pit to near lateral margin; surface densely punctured, punctures close, moderately deep on discal area, very deep laterally, each with fine, erect, brownish seta. Elytra about 2.0 times longer than wide; sides very weakly constricted on anterior third, weakly expanded behind, then arcuately converging to narrowly rounded apex, lateral margin weakly serrate on posterior third; humeral elevations prominent; surface shining; striae not impressed except on posterior third, punctures moderately impressed in regular rows; first and fifth interstriae weakly elevated, remainder flattened, punctures fine, each interstria with median row of fine, erect, brownish setae. Ventral surface finely punctured, with abundant white setae; last visible abdominal segment without subapical elevation. Aedeagus as in Fig. 72. Length 8.0-12.0 mm.

Hosts. Breeds in *Ceanothus integerrimus* and *C. velutinus* and in oak (*Quercus* spp.). Specimens also seen bearing labels "ex *Rosa nutkana*" [sic].

Distribution. Southern British Columbia to California, Nevada, and Utah.

Comments. This species is easily recognized by the uniformly black color, with several small reddish or yellowish spots on the elytra.

Burke (1917) states that adults and larvae feed in the wood of injured roots. Adults are sometimes collected on flowers of rose (*Rosa* spp.) and mountain mahogany (*Cercocarpus ledifolius*).

Nothing is known of the habits or life history of this species.

Acmaeodera tubulus (Fabricius)

Fig. 73; Map 3

Buprestis tubulus Fabricius, 1801:200.

Acmaeodera tubulus: Fall 1899:31; Knull 1925:7; Chamberlin 1926:38; Wellso et al. 1976:12.

Buprestis culta Weber, 1801:75.

Buprestis geranii Harris, 1829:3.

Description. Head and pronotum uniformly black; elytra reddish brown to black, with usually 8 round, yellowish spots on each elytron, these sometimes coalescing, forming short vittae, or sometimes divided, resulting in more than eight spots on each elytron. Head with frons strongly convex, with weak, longitudinal, median impression on occiput; surface densely punctured, punctures large, shallow, and each with erect, light brown to white setae; epistoma shallowly emarginate. Pronotum about 1.8 times wider than long, widest just behind middle; sides broadly arcuate, more strongly converging anteriorly; disc evenly convex, with shallow pit on each side near base; surface densely punctured, punctures very close, deep, each with an erect, light brown seta. Elytra about 2.3 times longer than wide; sides very weakly constricted on anterior fourth, weakly expanded behind, arcuately converging on posterior third to narrowly rounded apices, lateral margin weakly serrate on posterior fourth; humeral elevations prominent; surface moderately shining, striae narrowly impressed, with small, deep punctures arranged in regular rows; interstriae convex, with median row of fine punctures and erect, rather short, stout, white setae, these about equal to or slightly longer than interstrial width. Ventral surface finely, densely punctured, with abundant, fine, recumbent white setae; last visible abdominal sternite without subapical elevation. Aedeagus as in Fig. 73. Length 4.7-6.5 mm.

Hosts. Breeds in hawthorn (*Crataegus* spp.), hickory (*Carya* spp.), white oak (*Quercus alba*), redbud (*Cercis canadensis*), and spoon flower (*Dasylirion wheelari*). Taken on flowers of several herbaceous plants.

Distribution. Ontario to Florida, west to Texas, Nevada, and Idaho.

Comments. Adults of this species are easily recognized by the dark brown to black elytra, with eight yellow spots on each elytron. These spots vary in size and placement, several may combine and form irregular, transverse vittae or some may be divided so that more than eight spots are discernible. In most specimens seen, however, eight spots on each elytron is usual.

Other than the host plants, nothing is known of the habits or life history of this species.

Acmaeodera idahoensis Barr

Fig. 74; Map 3

Acmaeodera idahoensis Barr, 1969*a*:331; Barr 1971:86.

Description. Head and pronotum black; pronotum sometimes with small, reddish spot on lateral margin basally; elytra black or blackish bronze with 4 irregular, yellowish, elongate spots that (except first spot) extend onto disc. Head with frons convex, without median carina on vertex; surface densely punctured, punctures small, deep, each with fine, erect, brownish setae; epistoma broadly, deeply emarginate. Pronotum about 2.0 times wider than long, widest near middle; disc convex anteriorly, broadly impressed basally and with shallow, oblique, lateral impression extending from basal pits anteriorly to lateral margin; surface densely punctured, punctures close, moderately deep, coarser laterally, each with fine, erect, brownish setae. Elytra about 2.1 times longer than wide; sides subparallel on basal two-thirds, then arcuately converging to broadly rounded apex, lateral margin weakly serrate on posterior third; humeral elevations prominent; surface shining, broadly impressed and confusedly punctured at base; striae distinctly impressed, punctures large, deeply impressed; interstriae flat, finely punctured, bearing median row of fine, erect, brownish setae. Ventral surface finely punctured, with abundant, brownish setae; last visible abdominal sternite without a subapical elevation. Aedeagus as in Fig. 74. Length 7.0–13.0 mm.

Hosts. Breeds in mountain mahogany (*Cercocarpus ledifolius*) and hackberry (*Celtis occidentalis*). Adults have been collected from flowers of many different plants.

Distribution. Southeastern British Columbia, south through Idaho and eastern Washington to western Montana, Wyoming, northern Utah, Nevada, Oregon, and California.

Comments. *A. idahoensis* and *diffusa* Barr (not in Canada) have been known for many years but erroneously referred to as *variegata*. *A. variegata* is a different species in another species group that is recognized by the presence of a subapical elevation on the last abdominal sternite.

Adults of *idahoensis* are easily recognized by the basally impressed pronotum and by the color pattern.

Other than the host plants, nothing is known of the habits or life history of this species.

Genus *Anambodera* Barr

This genus, which was segregated from *Acmaeodera* by Barr (1974), contains five species. One species occurs in Canada.

Description. Head convex; epistoma with front margin not reflexed or narrowly expanded over base of mandibles. Antennae variable in length, serrate from fourth or fifth segments. Eyes widely separated, large, elliptic, and vertical. Pronotum wider than long, usually convex; sides arcuate, broadly, weakly bisinuate in front; base subtruncate; surface reticulately punctured, with distinct subbasal pit laterally, usually also with median subbasal pit. Scutellum not visible. Elytra elongate, truncate at base, without longitudinal costae, apex narrowly rounded, lateral margins serrate posteriorly. Prosternum strongly retracted in front, not lobed or toothed. Suture between first and second abdominal sternites visible. Legs short, moderately stout; tarsal claws cleft.

Comments. No keys to the species in this genus are available.

Anambodera gemina (Horn)

Acmaeodera gemina Horn, 1878:23; Chamberlin 1926:20; Barr 1971:85.
Anambodera gemina: Barr 1974:9.
Acmaeodera nebulosa Horn, 1894:376.

Description. Head and pronotum black; elytra dark brown to black, with an irregular, yellow, longitudinal stripe on each elytron, this stripe sometimes regular or variously expanded or interrupted. Head strongly convex, flattened above epistoma; surface densely punctured, punctures large, shallow, each bearing a fine, light brown seta; epistoma shallowly arcuate. Antennae serrate from fifth segment. Pronotum about 1.7 times wider than long, widest on posterior half; sides moderately arcuate; disc convex, with distinct, median, subbasal pit, lateral subbasal pits obscure; surface densely punctured, punctures large, shallow, each with a fine, moderately long, brown seta. Elytra about 2.3 times longer than wide; sides very weakly constructed on anterior third, weakly expanded, then arcuately converging to broadly rounded apex, lateral margin weakly serrate posteriorly but serrations usually not visible from above; humeral elevations prominent; surface moderately shining; striae distinctly impressed, punctures large, deep; interstriae as wide as striae, minutely rugose-granulate, with median row of short, erect, light brown setae, these only slightly longer than interstrial width. Ventral surface finely, densely punctured, with abundant, short, fine, recumbent, light brown setae; suture between first and second abdominal sternites weakly visible. Length 4.5–6.8 mm.

Hosts. Larval habits unknown. Adults taken on wild buckwheat (*Polygonum convolvulus*) or on the ground.

Distribution. Southern British Columbia, south to southern California.

Canadian records. Alta Lake and Mons, B.C.

Comments. Adults of this species should be easily recognized by the foregoing generic and specific characters.

Nothing is known of the habits or life history of this species.

Genus *Chalcophora* Solier

This is a genus of large, roughly sculptured species. They occur in partly decayed stumps and trunks of pines and also attack scars on living trees. Living trees may be severely damaged by larvae tunneling in the wood. Pine logs left in the wooded areas for a long time are also subject to severe damage by the larvae. Despite such attacks, tree damage is usually negligible except after severe wind storms or when fires kill large quantities of timber.

Description. Body robust, elongate–oval; coppery to dull black, mottled. Head convex, deeply narrowly impressed on midline; surface roughly sculptured; eyes large, elliptic, convex, inner margins straight; antennal segments slightly flattened, first segment subovate, longer than other segments, second segment small, subglobose, segments 3–8 nearly equal in size, slightly shorter than first, three terminal segments suboval (Fig. 31). Pronotum wider than long; anterior margin straight, then sharply curved toward extended lateral angles; sides moderately to strongly arcuate; disc with wide, smooth, shining, elevated, median elevation extending entire length, bordered on each side by narrow punctate impression giving bisulcate appearance; lateral areas moderately elevated with large, irregular, punctate impressions; submarginal areas swollen posteriorly, roughly punctured and sculptured; hind angles acute, inconspicuous. Scutellum longer than wide, small. Elytra slightly wider than pronotum; sides weakly recurved on basal one-fourth, then broadly arcuate and converging to apex; apex narrowly rounded; disc with suture costate to apex, costa narrow, smooth, shining, sparsely punctured, bordered by a similar but more irregular costa, interstrial space narrow, densely punctured, lateal areas with irregular, elevated, smooth callosities, with impressed, densely punctured, irregular foveae, these larger than elevated callosities. Ventral surface finely punctured, pubescent; prosternal process widened behind procoxae. First abdominal sternite longer than second, with a shallow, median impression; sternites 2–4 subequal in length; fifth sternite subtriangular, apex acute (♀) or deeply emarginate (♂).

Comments. This genus contains four species, three of which occur in Canada. The genus has never been revised; Wellso et al. (1976) keyed the three species occurring in Michigan.

Key to species of *Chalcophora* in Canada

(Modified from Wellso et al., 1976)

1. Subsutural groove on basal portion of elytra distinct, lateral costa joining sutural costa at basal one-fourth; general body color greenish to coppery with brassy or greenish metallic reflections; Manitoba to Quebec and New Brunswick 2

   Subsutural groove on basal portion of elytra obscure or absent, lateral and sutural costa contiguous or subcontiguous; general body color shining black; transcontinental .... ***virginiensis* (Drury)** (p. 42)

2. Body size small, 19–24 mm; dorsal surface with coppery reflections; elytral apex truncate to broadly rounded; median lobe of aedeagus with sides straight, converging to acute apex (Fig. 77) .... ***liberta* (Germar)** (p. 45)

Body size large, 24–32 mm; dorsal surface with greenish reflections; elytral apex moderately obtuse; median lobe of aedeagus with sides straight, subparallel, abruptly curved to short acuminate apex (Fig. 78) . . ***fortis* LeConte** (p. 46)

Tableau des espèces de *Chalcophora* du Canada

(modifiée de Wellso *et al.*, 1976)

1. Sillon subsutural sur la partie basale des élytres distinct, costa latérale joignant la costa suturale sur le quart basal; couleur générale du corps verdâtre à cuivrée avec des reflets métalliques verdâtres ou cuivré jaune; Manitoba jusqu'au Québec et au Nouveau-Brunswick 2

Sillon subsutural sur la partie basale des élytres obscur ou absent, costae latérale et suturale contigues ou subcontigues; couleur générale du corps d'un noir brillant; transcontinental .... ***virginiensis* (Drury)** (p. 42)

2. Espèce de petite taille, 19–24 mm; surface dorsale avec des reflets cuivrés; apex de chaque élytre tronqué à largement arrondi; côtés du lobe médian de l'édéage droits, convergent vers l'apex aigu (fig. 77) ... ***liberta* (Germar)** (p. 45)

Espèce de grande taille, 24–32 mm; surface dorsale avec des reflets verdâtres; apex de chaque élytre modérément obtus; côtés du lobe médian de l'édéage droits, subparallèles, brusquement courbés vers l'apex court, acuminé (fig. 78) .... ***fortis* LeConte** (p. 46)

Chalcophora virginiensis (Drury)

Figs. 23, 26, 76, 80; Map 4

Buprestis virginiensis Drury, 1770:66.

Chalcophora virginiensis: Casey 1909:77; Knull 1925:8; Chamberlin 1926:132, Craighead 1950:193; Baker 1972:167.

Buprestis cupreomaculata Goeze, 1777:596.

Buprestis angulicollis LeConte, 1857:44.

Chalcophora angulicollis: Chamberlin 1926:128; Barr 1971:57.

Chalcophora lacustris LeConte, 1860:190.

Buprestis novaeboracensis Fitch, 1859:701.

Buprestis obscurata Fitch, 1859:701.

Chalcophora virginiensis obliterata Casey, 1909:78.

Chalcophora lacustris brevicollis Casey, 1909:79.

Chalcophora angulicollis montana Casey, 1909:80.

Chalcophora prominens Casey, 1909:81.

Chalcophora brevicollis Muttkowski, 1910:136.

Chalcophora melanotum Muttkowski, 1910:135.

Chalcophora ingens Casey, 1914:360.

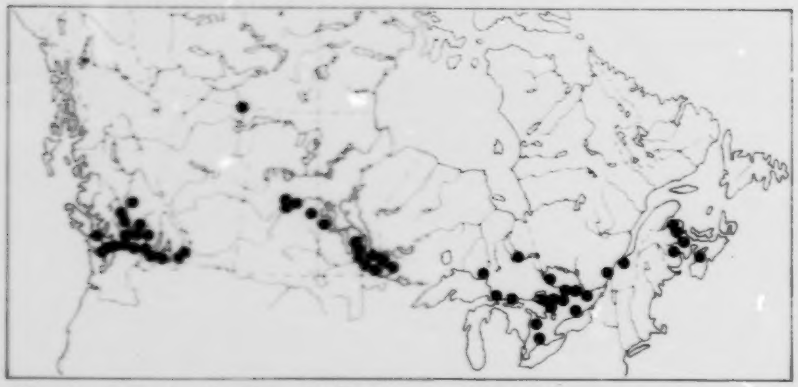
Chalcophora virginiensis antennalis Casey, 1914:360.

Chalcophora pallida Kerremans, 1919:48.

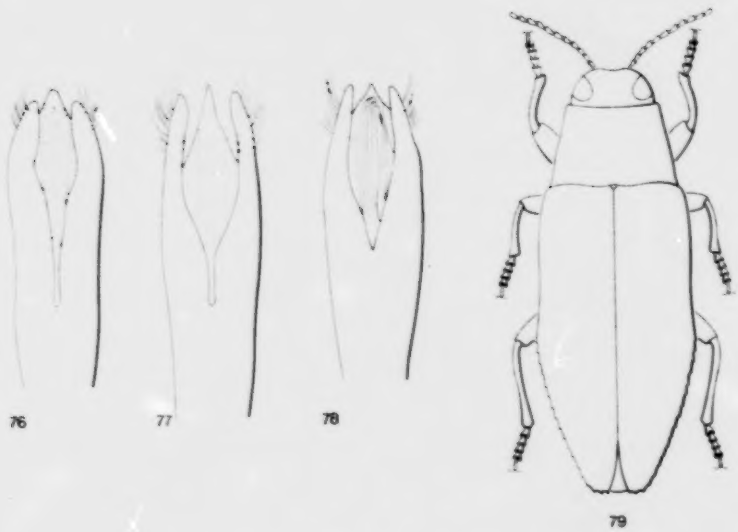
Description. Shining black, with impressed areas of pronotum and elytra dull black to gray, sometimes with bronzy luster. Head sparsely pubescent, surface deeply, closely punctured except on two very irregular, elevated, longitudinal areas, punctures large. Pronotum widest in front of middle; sides moderately angulate before middle in female, more rounded in male, then subparallel and converging to base; disc with median line broad, not elevated, bordered by two narrow, weakly impressed, densely punctured areas; lateral areas with irregular, large, raised, smooth areas interspersed with densely punctured, irregular, weakly impressed areas; submarginal area subinflated posteriorly. Elytra wider than pronotum; sides weakly, broadly undulating, subparallel on basal two-thirds, then gradually narrowing to apex; apex narrowly rounded; disc irregularly sculptured with densely punctured impressed areas and raised, smooth, generally longitudinal, impunctate, shining areas; sutural costa elevated from base to apex; subsutural groove absent or obsolete. Ventral surface with abdominal sternites densely, finely punctured except impunctate along posterior margin; prosternal process bisulcate, sulci densely punctured and pubescent; apex of last visible abdominal sternite entire, narrowly rounded (♀) or deeply incised (♂). Aedeagus as in Fig. 76. Length 25–31 mm.

Hosts. Known from jack pine (*Pinus banksiana*), lodgepole pine (*P. contorta*), ponderosa pine (*P. ponderosa*), red pine (*P. resinosa*), eastern white pine (*P. strobus*), Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), and white fir (*A. concolor*). Probably occurs in most coniferous tree species.

Distribution. Transcontinental, extending south to Arizona, New Mexico, and Florida; also introduced into Europe.



Map 4. Collection localities of *Chalcophora virginiensis*.



Figs. 76–79. 76–78, Aedeagi of *Chalcophora* spp.; 76, *C. virginiensis*; 77, *C. liberta*; 78, *C. fortis*; 79, *Texania campestris*.

Comments. This is the largest species of Buprestidae occurring in Canada. It is also one of the most common. Previous workers have recognized two large, similar species, an eastern one called *virginiensis* and a western one called *angulicollis*. I have carefully searched for consistent external morphological differences that would support maintaining both species but have been unsuccessful. The male genitalia was also examined and compared and no consistent differences could be found. Because of the absence of morphological differences, the similarity of host plants, and the contiguous distributions, I can recognize only the one species.

This is a variable species, a fact which has led to the naming of numerous forms. Variations occur mainly in the degree of distinctness of the body sculpturing and in the color.

This species is known in the west as the sculptured pine borer and in the east as the large flatheaded pine heartwood borer. Little is known of its biology or life history. Eggs are laid around scars on living areas and in bark crevices and holes in the bark of logs and stumps. Living trees can be severely damaged by the larval tunnels in the wood. Pine logs left too long in the woods are also subject to severe damage (Baker 1972).

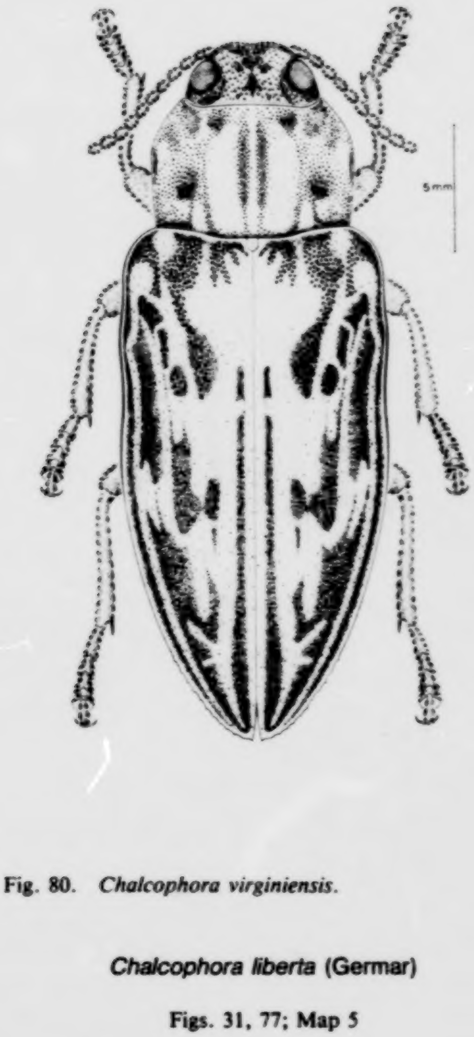


Fig. 80. *Chalcophora virginiensis.*

Chalcophora liberta (Germar)

Figs. 31, 77; Map 5

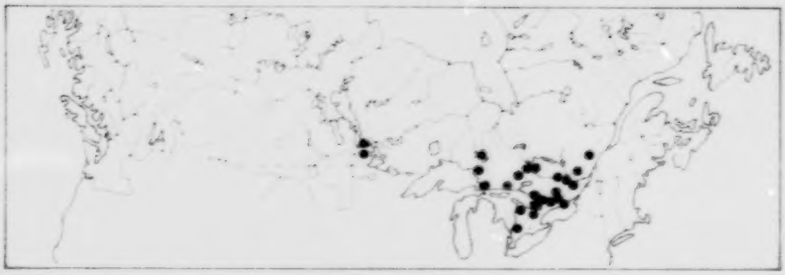
Buprestis liberta Germar, 1824:38.

Chalcophora liberta: Knull 1925:9; Chamberlin 1926:131; Craighead 1950:193; Wellso et al. 1976:6.

Buprestis borealis Gory and Laporte, 1841:13.

Chalcophora parviceps Casey, 1909:83.

Description. Coppery, with numerous raised, smooth, irregular black areas. Head sparsely pubescent, surface deeply, closely punctured except on two longitudinal, raised areas, punctures large. Pronotum widest in front



Map 5. Collection localities of *Chalcophora liberta*.

of middle; sides moderately arcuate to subparallel; disc with median line narrow, bordered by two narrow, moderately punctate, longitudinal impressions; lateral areas with irregular, large, raised areas and densely, deeply punctured, irregular, impressed areas; submarginal area subinflated posteriorly. Elytra wider than pronotum; sides broadly undulating, subparallel on basal two-thirds, then gradually narrowing to apex; apex narrowly rounded; disc irregularly sculptured with densely punctured impressed areas and raised, smooth, generally longitudinal, impunctate black areas; sutural costa elevated from base to apex; subsutural costa prominent, joining sutural costa at point on basal one-fourth; subsutural groove evident. Ventral surface with abdominal sternites densely, finely punctured except impunctate along posterior margin; prosternal process bisulcate, sulci densely punctured; apex of last abdominal sternite entire, very narrowly rounded (♀) or deeply incised (♂). Aedeagus as in Fig. 77. Length 19–24 mm.

Hosts. Recorded only from pines (*Pinus* spp.).

Distribution. Manitoba to Quebec, south to Florida and Texas, west to Indiana and Michigan.

Comments. This is the smallest species of *Chalcophora* occurring in Canada. The coppery tinge on the punctured areas of the elytra and pronotum contrasting with the shining black, elevated, broken costa distinguishes this species from others in the genus.

Evidently, nothing is known about the biology other than its host plant.

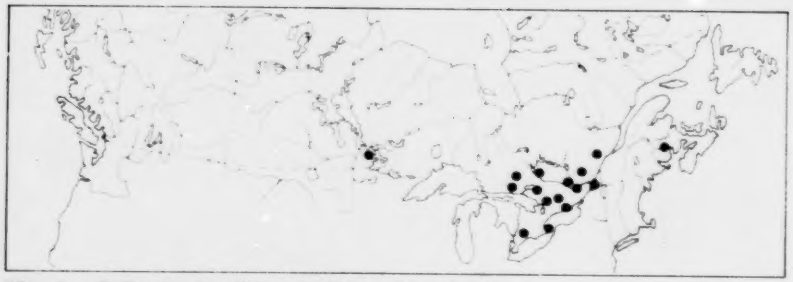
Chalcophora fortis LeConte

Fig. 78; Map 6

Chalcophora fortis LeConte, 1860:191; Casey 1909:82; Knull 1925:8; Chamberlin 1926:129; Craighead 1950:193; Wellso et al. 1976:6.

Chalcophora laurentica Casey, 1909:82.

Chalcophora cupreola Casey, 1914:360.



Map 6. Collection localities of *Chalcophora fortis*.

Description. Metallic greenish to light coppery, with numerous raised black areas, otherwise similar to preceding species. Aedeagus as in Fig. 72. Length 24–32 mm.

Hosts. Known from eastern white pine (*Pinus strobus*) and Scotch pine (*P. sylvestris*). Probably occurs in most pine species in its range.

Distribution. Manitoba to New Brunswick, through the New England states west to Michigan.

Comments. This eastern species is easily distinguished by its large size and by the greenish or slightly coppery reflections on the impressed areas on the elytra and pronotum. It is sympatric with *liberta* in the northern parts of the latter's range.

No details of the biology or life history of this species are known other than the hosts given here.

Genus *Texania* Casey

Members of this genus are characterized by the roughly, irregularly sculptured upper surface, by the unisulcate dorsal surface of the pronotum, by the narrowly and deeply emarginate epistoma, and by the other characters given in the key to genera.

The habits of members of this genus are unknown except that they are found in hardwoods. Three species occur in North America, only one of which occurs in Canada.

In most North American literature this genus is referred to as *Chalcophorella*, with *Texania* as a synonym. Obenberger (1942), followed by Nelson (1981), have restricted *Chalcophorella* for species from Europe and southern Asia and recognized *Texania* for North American species.

Description. In general, similar to *Chalcophora* but differs by the impressed, punctate, and apparently unisulcate median line of the pronotum and by the strongly serrate apical one-third elytral margins.

Texania campestris (Say)

Fig. 79

Buprestis campestris Say, 1823:165.
Texania campestris: Casey 1909:85.
Chalcophorella campestris: Knull 1925:9; Chamberlin 1926:134; Craighead 1950:193; Baker 1972:168.
Buprestis substrigosa Gory and Laporte, 1841:13.

Description. Upper surface bronze; lower surface greenish to greenish bronze or bright copper. Head convex, with a deep, median sulcus extending from epistomal margin to vertex; surface roughly punctured, bearing short, whitish setae; epistomal margin deeply, acutely emarginate. Antennae reaching to beyond middle of pronotum at sides; second segment much shorter than first or third. Pronotum with distinct, median sulcus extending from anterior margin to posterior margin; surface coarsely, roughly punctured and rugose; elevated areas smooth, frequently with scattered punctures; hind angles moderately extended; vestiture absent. Scutellum small, round. Elytra wider at base than pronotum, narrowly produced at apex; lateral margin beyond middle strongly serrate; disc coarsely granulate-rugose, with 4 narrow, elevated costae, these frequently interrupted by large, circular, impressed areas; surface of elevated costae and other areas dull to shining, smooth and minutely reticulate. Ventral surface with prosternum coarsely punctured and rugose; prosternal process mirrorlike except on narrow, impressed, median area; abdominal sternites finely, closely punctured; apex of last visible abdominal sternite narrowly rounded (♂) or deeply, acutely emarginate (♀). Length 20–30 mm.

Hosts. Known from various species of maple (*Acer*), beech (*Fagus*), sycamore (*Platanus*), poplar (*Populus*), oak (*Quercus*), willow (*Salix*), and basswood (*Tilia*), and probably occurs in other hardwood species.

Distribution. Southern Ontario, New York, and Pennsylvania, south through the eastern states.

Canadian record. Rondeau Provincial Park, Ont., *Fagus grandifolia*.

Comments. This species varies in color from evenly bronze to green with a bronze tint. The elevated areas of the pronotum and elytra vary from a dull, minutely reticulate surface to a more brightly shining, smoother surface.

Baker (1972) refers to this species as the flatheaded sycamore-heartwood borer and states that the species prefers moist, rotting logs, but that it also occurs in injured, dying, or dead trees. He states that the species often attacks at axe blazes and woods and frequently riddles the wood beneath with its tunnels.

In addition to the key characters of the genus, adults of this species are easily recognized by the distinctly serrate lateral margins of the posterior half of the elytra.

Genus *Spectralia* Casey

In addition to the characters in the key to genera, members of this genus may be recognized by the small but distinct scutellum and by the smooth elytral bases.

The genus contains five species in North America, only one species occurs in Canada.

Description. Body elongate, 3.0–5.0 times longer than wide, subcylindrical; shining black to blackish green. Head evenly convex, with several, elevated, impunctate areas; surface deeply punctured except on elevated areas; clypeus deeply, acutely notched; eyes prominent, elongate-oval. Antennae extending well beyond middle of pronotum; segments 5–7 subtriangular, 8–10 subquadrate, 2 much shorter than 3 (Fig. 29). Pronotum slightly broader than long; disc smooth, punctured, with impressed, more densely punctured median, longitudinal line and weakly impressed areas near hind angles. Elytra slightly wider than pronotum, strongly narrowed posteriorly; surface with striae weakly impressed, interstriae weakly convex, with median row of large punctures. Ventral surface finely punctured; prosternal process wider than coxae at level of coxae, separated from mesosternum by a deep cleft. First abdominal sternite convex medially, suture between first and second sinuate, fifth sternite triangular, apex truncate or narrowly rounded. First tarsal segment on metatarsus, with plantula occupying less than half of segment.

Comments. Little is known of this genus or the species contained therein. Chamberlin (1920*a*) gives a key to four species.

Spectralia gracilipes (Melsheimer)

Figs. 29, 81

Dicerca gracilipes Melsheimer, 1845:145.

Cinyra gracilipes: Knull 1925:17; Chamberlin 1926:178; Craighead 1950:197; Wellso et al. 1976:8.

Spectralia gracilipes: Casey 1909:175; Casey 1914:363.

Description. Black to violet bronze on dorsal and ventral surfaces, usually more bronze ventrally. Head convex, usually with prominent median, circular callus between eyes, and with two irregular, elevated, and more roughly and sparsely punctured areas, one on each side and slightly below median callosity; surface densely, strongly punctured except on elevated callosities, and bearing moderately long, white setae; epistoma deeply incised. Pronotum with lateral margins distinctly elevated on posterior three-fourths; disc longitudinally sulcate in middle and weakly impressed laterally halfway between lateral line and midline; surface irregularly punctured, punctures close in lateral impressed areas and on anterior portions, less close on elevated areas between impressed midline and impressed lateral areas. Elytra with entire dorsal surface irregularly punctured and bearing several irregular, impressed areas; striae weakly impressed but visible, especially on posterior half; interstriae distinctly wider than striae, one, three, five, seven, and nine weakly convexly elevated. Ventral surface densely punctured; prosternum wider than coxae at level of coxae, not widened behind coxae; abdominal sternites more finely punctured, bearing short, recumbent, white setae; apex of last visible abdominal sternite truncate (♀) or weakly emarginate (♂). Length 10.0–11.0 mm.

Hosts. Recorded from oak (*Quercus* spp.), hop hornbeam (*Ostyra* spp.), hawthorn (*Crataegus* spp.), and on flowers of goldenrod (*Solidago* spp.).

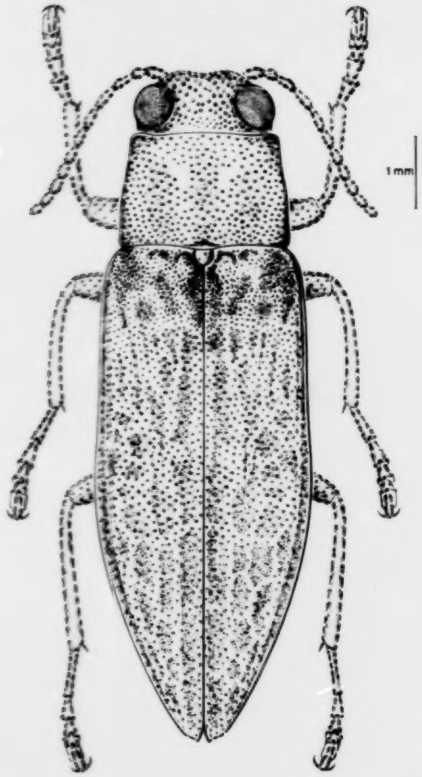


Fig. 81. *Spectralia gracilipes.*

Distribution. Southern Ontario, through the eastern United States, south to South Carolina and Mississippi, west to Kansas.

Canadian record. Grimsby, Ont.

Comments. Adults can be readily recognized by the characters given under the description.

Nothing is known of the habits or life history of this species except that it breeds in dead branches (Baker 1972).

Genus *Dicerca* Eschscholtz

In addition to the characters given in the key, members of *Dicerca* may be distinguished from those belonging to other genera in the Buprestini by the antennae being inserted in large, triangular depressions ridged on two sides, by the segments of the antennae possessing sensory pores in depressions on the underside at the apex, by the enlarged last segment of the maxillary palpi which is either triangular or oval, by the pronotum being closely punctate or depressed on the midline, and by the first segment of the metatarsi being smaller than the second segment.

The adults may be found during the warm months flying to or sitting on logs, trunks, limbs, or foliage of their host plants or resting on other plants. Eggs are laid in cracks or crevices on the bark or wood of recently dead or dying trees or on dead parts of living trees. An exception is *pugionata* Germar, in which the larvae apparently feed in healthy living witch hazel (*Hamamelis* spp.), alder (*Alnus* spp.), and ninebark (*Physocarpus* spp.). The larvae of all species feed in the cambium layer or the heartwood. Little is known about the life history, development time, or other aspects of the biology of any of the species of *Dicerca* in North America.

Eighteen species are known or suspected to occur in Canada and Alaska.

Description. Body elongate, oval, generally strongly acuminate at apex; color brassy, coppery, or dull brown to black, sometimes with greenish tint. Head flat or slightly impressed, rugose; clypeus short, emarginate; eyes widely separated, closer on vertex. Antennae slender, first segment robust, second and third segments shorter, more slender, apical segments serrate, each with sensory impression on posterior surface at apical margin (Figs. 32, 33). Pronotum wider than long, sides variable, anterior margin arcuately emarginate, basal margin bisinuate; surface with median, punctate impression, laterally with punctate areas and elevated impunctate areas. Elytra elongate, sides slightly sinuate, apex acuminate and often prolonged, surface variably punctured, with raised impunctate callosities. Ventral surface finely punctured; prosternal process concave, flat, or convex, sides not strongly constricted by coxae, narrowed at apex. First abdominal sternite flat or concave medianly, apex of last sternite variable.

Comments. This genus was revised by Nelson (1975).

Key to species of *Dicerca* in Canada and Alaska

(Modified from Nelson (1975))

1. Tip of elytron entire, truncate, or weakly bidentate (Figs. 100–113) 2
Tip of elytron strongly bidentate (Figs. 114–116, 118) 16

2. Second segment of antennae distinctly shorter than third (Fig. 32); elytra generally not produced to moderately produced at apex 3
Second segment of antennae as long as or very slightly shorter than third (Fig. 33); elytra generally strongly produced at apex 11

3. Elytral setae long, especially at sides; smooth raised areas of elytra small and inconspicuous (Fig. 117); southern British Columbia; in angiosperms ..... ***hornii* Crotch** (p. 55)
Elytral setae short or elytra glabrous; smooth raised areas of elytra generally prominent; in conifers (except *pectorosa* LeConte) 4

4. Last ventral abdominal segment truncate, with two longitudinal smooth raised areas and shorter median one at base; southern British Columbia to Saskatchewan; in *Prunus* spp. ..... ***pectorosa* LeConte** (p. 58)
Last ventral abdominal segment emarginate, tridentate, or entire, with smooth raised areas not as above; in conifers 5

5. Mesotibia of male toothed (as in Fig. 53); last ventral abdominal segment of female tridentate; head with irregular raised area on vertex between eyes; transcontinental ..... ***tenebrosa* (Kirby)** (p. 58)
Mesotibia of male simple (Fig. 52); last ventral abdominal segment of female entire; head without irregular raised area on vertex between eyes except in *crassicollis*, which has transverse ridge between eyes 6

6. From southern British Columbia and Alberta 7
Eastern species 8

7. Elytra with basal and succeeding smooth raised areas of third interstriae separated by punctate area (Fig. 101); last ventral abdominal segment of female tridentate ..... ***crassicollis* LeConte** (p. 60)
Elytra with basal and succeeding smooth raised areas of third interstriae connected by slender raised ridge (Fig. 102); last ventral abdominal segment of female entire ..... ***sexualis* Crotch** (p. 61)

8. Smooth areas of elytra inconspicuous; color dark brown or black or with a coppery tinge above 9
Smooth areas of elytra conspicuous; color brassy brown, coppery, or green above 10

9. Pronotal side margins strongly expanded; elytral tips moderately produced (Fig. 105); Northwest Territories to New Brunswick ..... ***lugubris* LeConte** (p. 62)
Pronotal side margins not expanded or weakly so; elytral tips weakly produced (Fig. 104); Ontario ..... ***punctulata* (Schoenherr)** (p. 63)

10. Body color brassy brown; smooth areas of pronotum and elytra strongly raised; pronotal side margin abruptly expanded (Fig. 103); Saskatchewan to Quebec ..... ***dumolini* (Gory & Laporte)** (p. 64)
Body color iridescent green or coppery; smooth areas of pronotum and elytra moderately raised; pronotal side margin gradually expanded (Fig. 106); Ontario to Nova Scotia ..... ***tuberculata* (Gory & Laporte)** (p. 65)

11. Median channel of pronotum well-developed; punctures on lateral portion of pronotum generally coarse and more rugose (Figs. 108, 109, 110, 112) 12

Median channel of pronotum faintly indicated; punctures on lateral portion of pronotum moderate and less rugose (Figs. 111, 113) 15

12. Elytral striae obsolete in broadly punctured areas, punctures large, coarse, rough (Figs. 108, 109); mesotibia of male simple or with slight dilation (as in Fig. 54) 13

Elytral striae weakly to distinctly impressed, punctures finer, more distinct (Figs. 110, 112); mesotibia of male with well-developed tooth (Fig. 53) 14

13. Occurs from central Alaska across Canada to Maritime Provinces .... ***callosa callosa* Casey** (p. 66)

Occurs in southern British Columbia and Alberta and throughout western United States .... ***callosa frosti* Nelson** (p. 68)

14. Median carina of antecoxal piece without groove, or groove weakly indicated; in *Populus* spp.; transcontinental .... ***tenebrica* (Kirby)** (p. 68)

Median carina of antecoxal piece with prominent groove; in *Betula* spp., and *Alnus* spp.; British Columbia, Alberta .... ***hesperoborealis* Hatch & Beer** (p. 70)

15. Pronotum widest at middle; elytral striae finely but usually distinctly indicated (Fig. 113); central Alberta to Nova Scotia ..... ***divaricata* (Say)** (p. 71)

Pronotum widest at base and feebly rounded to apex (sometimes subparallel toward base); elytral striae faintly indicated (Fig. 111); Northwest Territories to Nova Scotia .... ***caudata* LeConte** (p. 72)

16. Elytral tips distinctly prolonged (Fig. 114); southern Ontario .... ***pugionata* (Germar)** (p. 73)

Elytral tips not prolonged or only very faintly so (Figs. 115, 116, 118) .. 17

17. Raised smooth areas of pronotum and elytra distinctly indicated 18

Raised smooth areas of pronotum and elytra only weakly indicated (Fig. 118); Ontario and Quebec .... ***lurida* (Fabricius)** (p. 74)

18. Transverse smooth callous between eyes feebly indicated; front of head flat; body narrow, brassy coppery, punctate areas moderately coarse and uniform (Fig. 115); probably in southern Ontario .... ***lepida* LeConte** (p. 75)

Transverse smooth callous between eyes strongly indicated; body moderately robust, brassy, usually with greenish tinge, punctate areas very coarse and rugose (Fig. 116); probably in southern Ontario .... ***asperata* (Gory & Laporte)** (p. 76)

Tableau des espèces de *Dicerca* du Canada et de l'Alaska

(modifiée de Nelson (1975))

1. Apex de chaque élytre entier, tronqué, ou faiblement bidenté (fig. 100–113) 2

Apex de chaque élytre fortement bidenté (fig. 114–116, 118) 16

2. Deuxième article antennaire distinctement plus court que le troisième (fig. 32); élytres généralement non à modérément saillants à l'apex 3

Deuxième article antennaire aussi long ou un peu plus court que le troisième (fig. 33); élytres en général très saillants à l'apex 11

3. Élytres avec des soies longues, particulièrement sur les côtés; zones soulevées lisses des élytres petites et peu apparentes (fig. 117); sud de la Colombie-Britannique; dans les angiospermes .... ***hornii* Crotch** (p. 55)

Élytres glabres ou avec des soies courtes; zones soulevées lisses des élytres généralement saillantes; dans les conifères (sauf *pectorosa* LeConte) 4

4. Dernier sternite abdominal tronqué, avec deux zones soulevées longitudinales lisses et une autre médiane et plus courte, à la base; sud de la Colombie-Britannique à la Saskatchewan; dans *Prunus* spp. .... **pectorosa LeConte** (p. 58)

Dernier sternite abdominal échancré, tridenté, ou entier, avec des zones soulevées lisses différentes; dans les conifères 5

5. Mésotibia du mâle denté (comme sur la fig. 53); dernier sternite abdominal de la femelle tridenté; tête avec une zone soulevée irrégulière sur le vertex entre les yeux; transcontinental .... **tenebrosa (Kirby)** (p. 58)

Mésotibia du mâle simple (fig. 52); dernier sternite abdominal de la femelle entier; tête sans zone soulevée irrégulière sur le vertex entre les yeux, sauf chez *crassicollis*, qui possède une carène transverse entre les yeux 6

6. Espèces du sud de la Colombie-Britannique et de l'Alberta 7

Espèces de l'Est 8

7. Élytres avec la zone soulevée lisse basale et les suivantes sur le troisième interstrie séparées par une zone ponctuée (fig. 101); dernier sternite abdominal de la femelle tridenté .... **crassicollis LeConte** (p. 60)

Élytres avec la zone soulevée lisse basale et les suivantes sur le troisième interstrie jointes par une fine carène (fig. 102); dernier sternite abdominal de la femelle entier .... **sexualis Crotch** (p. 61)

8. Zones lisses des élytres peu apparentes; couleur brun foncé ou noir ou avec une teinte cuivrée sur le dessus 9

Zones lisses des élytres évidentes; couleur brun cuivré jaune, cuivré, ou vert sur le dessus 10

9. Marges latérales du pronotum fortement élargies; apex de chaque élytre modérément prolongé (fig. 105); Territoires du Nord-Ouest jusqu'au Nouveau-Brunswick .... **lugubris LeConte** (p. 62)

Marges latérales du pronotum non ou faiblement élargies; apex de chaque élytre faiblement prolongé (fig. 104); Ontario . **punctulata (Schoenherr)** (p. 63)

10. Corps d'un brun cuivré jaune; zones lisses du pronotum et des élytres fortement soulevées; marge latérale du pronotum brusquement élargie (fig. 103); Saskatchewan jusqu'au Québec .... **dumolini (Gory & Laporte)** (p. 64)

Corps d'un vert iridescent ou cuivré; zones lisses du pronotum et des élytres modérément soulevées; marge latérale du pronotum graduellement élargie (fig. 106); Ontario jusqu'à la Nouvelle-Écosse .... **tuberculata (Gory & Laporte)** (p. 65)

11. Sillon médian du pronotum bien développé; ponctuation sur la partie latérale du pronotum généralement grossière et plus rugueuse (fig. 108, 109, 110, 112) 12

Sillon médian du pronotum peu développé; ponctuation sur la partie latérale du pronotum plus typique et moins rugueuse (fig. 111, 113) 15

12. Stries des élytres effacées dans les zones ponctuées, la ponctuation large, grossière et rugueuse (fig. 108, 109); mésotibia du mâle simple ou avec un faible renflement (fig. 54) 13

Stries des élytres faiblement à distinctement marquées, la ponctuation plus fine, plus apparente (fig. 110, 112); mésotibia du mâle avec une dent bien développée (fig. 53) 14

13. Espèces réparties dans tout le Canada, du centre de l'Alaska jusqu'aux provinces Maritimes .... **callosa callosa Casey** (p. 66)

Espèces réparties dans le sud de la Colombie-Britannique et en Alberta et dans l'ouest des États-Unis .... **callosa frosti Nelson** (p. 68)

14. Carène médiane sur le sclérite antécoxal sans sillon ou avec un sillon peu marqué; dans *Populus* spp.; transcontinental .... **tenebrica (Kirby)** (p. 68)

Carène médiane sur le sclérite antécoxal avec un sillon bien marqué; dans *Betula* spp. et *Alnus* spp.; Colombie-Britannique, Alberta .... ***hesperoborealis*** **Hatch & Beer** (p. 70)

15. Pronotum plus large au milieu; stries des élytres fines mais en général distinctement marquées (fig. 123); centre de l'Alberta jusqu'en Nouvelle-Écosse .... ***divaricata*** **(Say)** (p. 71)

Pronotum plus large à la base et faiblement arrondi vers l'apex (parfois subparallèle vers la base); stries des élytres faiblement marquées (fig. 111); Territoires du Nord-Ouest jusqu'à la Nouvelle-Écosse .... ***caudata*** **LeConte** (p. 72)

16. Apex de chaque élytre distinctement prolongé (fig. 114); sud de l'Ontario .. .. ***pugionata*** **(Germar)** (p. 73)

Apex de chaque élytre non ou très faiblement prolongé (fig. 115, 116, 118) 17

17. Zones soulevées lisses du pronotum et des élytres distinctement marquées 18

Zones soulevées lisses du pronotum et des élytres faiblement marquées (fig. 118); Ontario et Québec .... ***lurida*** **(Fabricius)** (p. 74)

18. Callosité transverse lisse entre les yeux faiblement marquée; front plat; corps étroit, cuivré à cuivré jaune, les zones ponctuées modérément grossières et uniformes (fig. 115); probablement dans le sud de l'Ontario .... ***lepida*** **LeConte** (p. 75)

Callosité transverse lisse entre les yeux fortement marquée; corps modérément robuste, cuivré jaune, généralement avec une teinte verdâtre, les zones ponctuées très grossières et rugueuses (fig. 116); probablement dans le sud de l'Ontario .... ***asperata*** **(Gory & Laporte)** (p. 76)

Dicerca hornii Crotch

Figs. 82, 117; Map 7

Dicerca hornii Crotch, 1873:86; Chamberlin 1926:185; Barr 1971:58; Nelson 1975:156.

Dicerca hornii ampliata Casey, 1909:153.

Description. Reddish or greenish brassy to black, with coppery tints on dorsal surface, more coppery ventrally. Head flattened; surface coarsely, rugosely punctured, clothed with white setae and with numerous irregular, smooth, raised areas; vertex with slight median groove. Antennae reaching to middle of pronotal sides. Pronotum moderately convex, punctures moderately impressed in median area, coarse and rugose laterally, white setae moderately long; disc with longitudinal, smooth, elevated areas extending from base to apex next to punctate median channel, another midway to lateral margin interrupted by punctured area at middle, some irregular, smooth, elevated areas near lateral margin. Elytra slightly wider at base than pronotum; apices slightly prolonged; disc with punctured striae evident toward suture, confused laterally; punctured areas sparsely clothed with long, white setae; interstriae with small, black, elevated areas, interstriae carinate laterally. Ventral surface coarsely punctate at sides, with smooth, sparsely punctate areas bordering punctate, median, concave channel, concavity extending from

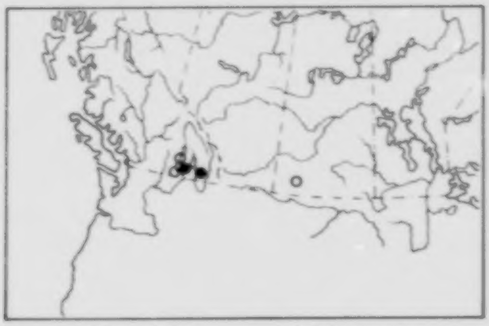
prosternum to second abdominal sternite; prosternum with transverse impression near anterior margin; punctate areas with long, white setae; mesotibia with acute internal spine (♂) or spine absent (♀); last visible abdominal sternite emarginate (♂) or entire or trilobed (♀). Aedeagus as in Fig. 82. Length 9.5-20.0 mm (♂); 11.0-22.0 mm (♀).

Hosts. Breeds in many species of deciduous trees and shrubs. Collected from sumac (*Rhus* spp.), redroot (*Ceanothus* spp.), willow (*Salix* spp.), alder (*Alnus* spp.), mountain mahogany (*Cercocarpus* spp.), and several additional hosts that do not occur in Canada.

Distribution. Southern British Columbia through the western United States to northern Baja California, Mexico.

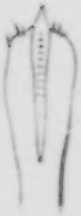
Comments. This species, which has a wide range of host plants, displays considerable variation. The general brassy coppery color varies to dark coppery black, or exhibits strong greenish tints. Occasionally, the median punctate channel of the pronotal disc is partially obliterated and the last ventral segment of the female, which is usually entire, is trilobed in some specimens.

Two subspecies of this species are recognized. The subspecies occurring in Canada is *hornii hornii*, which occurs in the range stated under distribution. The other subspecies, *hornii nelsoni*, occurs only in the southern Sierra Nevada in California.



Map 7. Collection localities of *Dicerca hornii* (•) and *D. pectorosa* (○).

Figs. 82-99. Aedeagi of *Dicerca* spp. (redrawn from Nelson 1975). 82, *D. hornii*; 83, *D. pectorosa*; 84, *D. tenebrosa*; 85, *D. crassicollis*; 86, *D. sexualis*; 87, *D. lugubris*; 88, *D. punctulata*; 89, *D. dumolini*; 90, *D. tuberculata*; 91, *D. callosa callosa*; 92, *D. tenebrica*; 93, *D. hesperoborealis*; 94, *D. divaricata*; 95, *D. caudata*; 96, *D. pugionata*; 97, *D. lurida*; 98, *D. lepida*; 99, *D. asperata*.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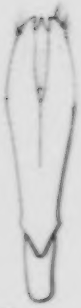
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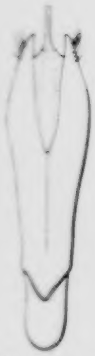
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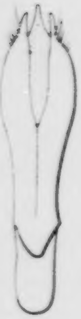
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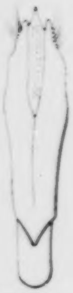
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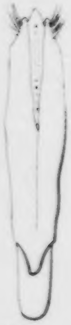
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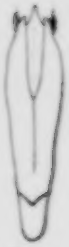
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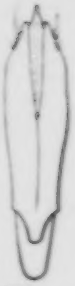
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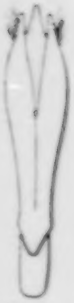
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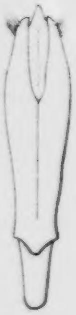
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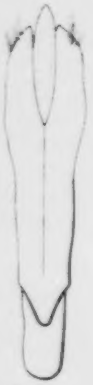
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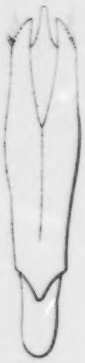
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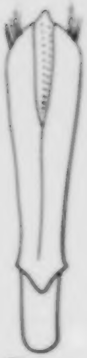
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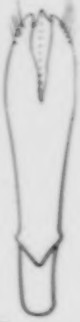
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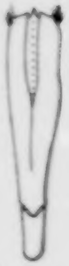
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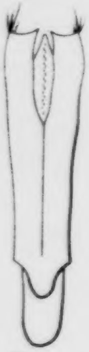
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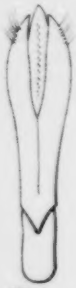
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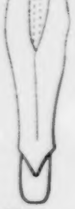
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Dicerca pectorosa LeConte

Figs. 83, 107; Map 7

Dicerca pectorosa LeConte, 1857:45; Chamberlin 1926:191; Barr 1971:58; Nelson 1975:119.

Description. Dark coppery to black dorsally, more coppery ventrally. Head flattened; surface coarsely, rugosely punctured with irregular, smooth, elevated areas and semirecumbent, white setae. Antennae reaching almost to middle of pronotal sides. Pronotum convex; disc with irregular surface, smooth, elevated areas bordering median channel, another midway to lateral margin interrupted by oblique depression behind middle, some irregular, elevated areas near lateral margin; punctures coarse and rugose laterally, smaller medially; white setae short, inconspicuous. Elytra slightly wider at base than pronotum; apices moderately prolonged, entire; disc with numerous, elevated, black areas interspersed with punctate areas, large strial punctures more evident medially; short, white, semirecumbent setae inconspicuous. Ventral surface coarsely, rugosely punctured laterally, with smooth, sparsely punctured areas bordering punctured median, concave channel, concavity extending from prosternum to first abdominal sternite; prosternum with transverse impression near distinctly bisinuate anterior margin; punctured areas with moderately abundant, semirecumbent, white setae; mesotibia simple in both sexes; last visible abdominal sternite truncate, entire in both sexes. Aedeagus as in Fig. 83. Length 11.8–16.2 mm (♂); 11.4–18.0 mm (♀).

Hosts. Reared from plum and prune trees in Oregon. Collected from chokecherry (*Prunus virginiana* var. *demissa*), deerbush (*Ceanothus integerrimus*), and rabbitbrush (*Chrysothamnus viscidiflorus*).

Distribution. Southern British Columbia to Saskatchewan, south through the western United States to southern California. One specimen reported from Ottawa, Ont., was probably either an accidental occurrence or an incorrectly identified specimen.

Comments. Adults of this species may vary from coppery to almost black; otherwise specimens show little variation in external appearance.

D. pectorosa is readily distinguished by having the last abdominal sternite truncate in both sexes, and by the host plants.

Dicerca tenebrosa (Kirby)

Figs. 32, 54, 84, 100; Map 8

Buprestis tenebrosa Kirby, 1837:155.

Dicerca tenebrosa: Knull 1925:14; Chamberlin 1926:197; Craighead 1950:195; Barr 1971:59; Nelson 1975:101.

Dicerca chrysea Melsheimer, 1845:143.

Dicerca bifoveata LeConte, 1860:202.
Dicerca distinguenda Saunders, 1871:37.
Dicerca acerba Casey, 1909:158.
Dicerca chrysea mystica Casey, 1909:159.
Dicerca montana Casey, 1909:160.
Dicerca wickhami Casey, 1909:160.
Dicerca stolida Casey, 1909:161.

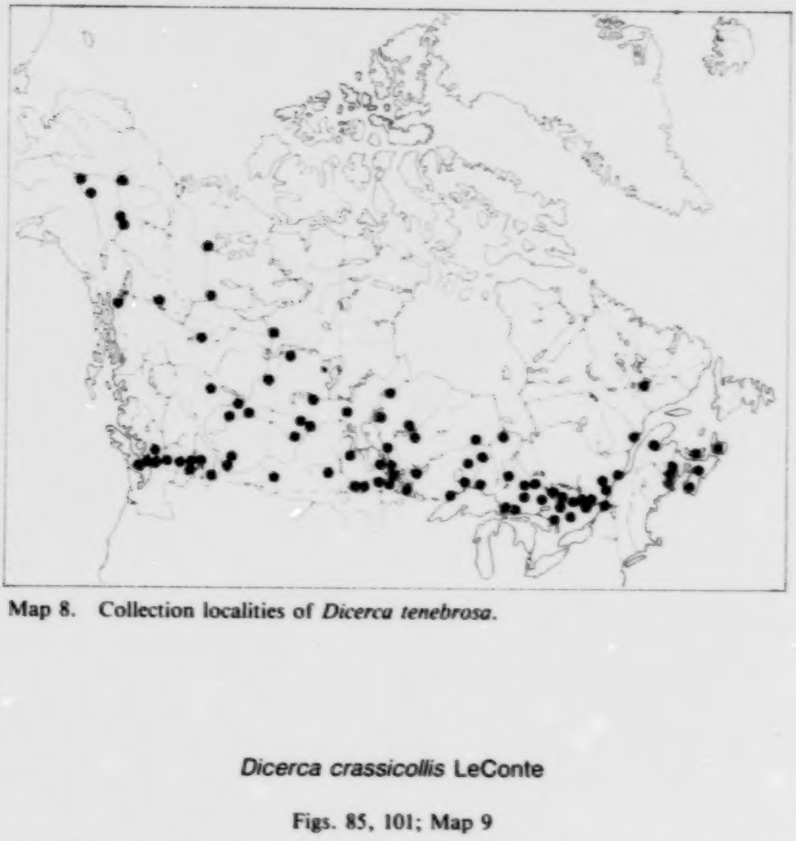
Description. Black to coppery dorsally, sometimes with greenish tints, dark coppery ventrally. Head flattened; surface coarsely rugosely punctured with irregular, smooth, elevated areas on frons and two longitudinal, smooth areas on vertex, punctured areas sparsely clothed with semirecumbent, white setae. Antennae reaching middle of pronotum at sides, third segment distinctly longer than second segment. Pronotum flattened; disc coarsely, rugosely punctured; median channel distinct, with small, irregular, smooth area at middle and longitudinal, smooth, elevated area on either side of channel extending from base to apex; longitudinal, smooth, elevated area located midway to lateral margin and interrupted by oblique depression; irregular, smooth, elevated areas extend forward from basal angles; short, recumbent, white setae inconspicuous or setae absent. Elytra wider at base than pronotum; apices slightly produced, entire; disc densely punctured, strial punctures large; surface with numerous, irregular, smooth, black, elevated areas, these becoming carinate toward apices. Ventral surface with prosternum densely, rugosely punctured, with transverse depression near anterior margin; prosternal process broadly concave, concavity extending to anterior part of first abdominal sternite and densely punctured and clothed with dense, suberect, white setae that extend to ventral surface of mesofemur; mesotibia with strong tooth (♂) or without tooth (♀) abdominal sternites rugosely punctured, punctures less dense medially and clothed with depressed, white setae; apex of last abdominal sternite emarginate (♂) or tridentate (♀). Aedeagus as in Fig. 84. Length 11.7-20.00 mm (♂); 10.5-22.0 mm (♀).

Hosts. Recorded from white fir (*Abies concolor*), balsam fir (*A. balsamea*), white spruce (*Picea glauca*), Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), lodgepole pine (*P. contorta*), limber pine (*P. flexilis*), jack pine (*P. banksiana*), and red pine (*P. resinosa*). Probably occurs in all conifers in its range.

Distribution. Transcontinental (except Newfoundland), through the western United States and the Lake states to the northeastern states.

Comments. This widespread species varies considerably in color from dull black to coppery or with a greenish tint. The ratio of punctate areas to smooth areas varies considerably. The smooth, black, elevated areas are occasionally strongly elevated. The lateral margins of the pronotum vary in the degree of expansion and the elytral apices are slightly variable.

Two subspecies of this species are recognized by Nelson (1975). The nominate subspecies occurs across Canada and in the range stated under distribution. The other subspecies, *tenebrosa knulli* Nelson, occurs from Virginia to northern Florida.



Map 8. Collection localities of *Dicerca tenebrosa*.

Dicerca crassicollis LeConte

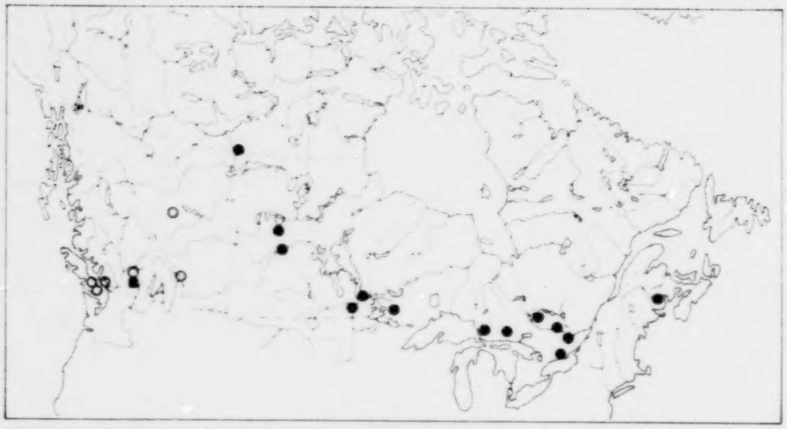
Figs. 85, 101; Map 9

Dicerca crassicollis LeConte, 1857:45; Chamberlin 1926:197; Barr 1971:59; Nelson 1975:106.

Dicerca californica Crotch, 1873:87.

Dicerca crassicollis hesperica Casey, 1909:155.

Description. Dark coppery brown dorsally with black elevations, shining coppery with purple cast ventrally. Head flattened; surface coarsely, rugosely punctured with transverse, elevated callus between eyes and less definite longitudinal, elevated callus on vertex, punctured areas sparsely clothed with short, semirecumbent, white setae. Antennae as in *tenebrosa*. Pronotum densely, rugosely punctured; median channel and raised smooth calli as in *tenebrosa* but more distinct; setae sparse, white, and inconspicuous. Elytra as in *tenebrosa* but tapering more abruptly to abbreviated, slightly emarginate apices; disc densely punctured; interstriae bearing moderately elevated, longitudinal, smooth, black areas; basal and succeeding elevated areas of third interstriae not connected. Ventral surface as in *tenebrosa* except median concavity narrower, setae not so sparse or extensive and



Map 9. Collection localities of *Dicerca crassicollis* (○), *D. lugubris* (●), and *D. sexualis* (■).

mesofemur not bearing dense setae beneath; apex of last visible abdominal sternite emarginate (♂) or tridentate (♀). Aedeagus as in Fig. 85. Length 13.2–17.7 mm (♂); 13.5–20.5 mm (♀).

Hosts. Recorded from Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), and California red fir (*Abies magnifica*).

Distribution. Southern British Columbia, Alberta, and Pacific Coast states from southern California to Washington, east to Idaho.

Comments. Adults of this species vary from coppery brown to almost black. The elytral apices are sometimes merely truncate with the sutural angle slightly produced, and the elevated areas are occasionally fairly strongly indicated.

Adults of *crassicollis* are often confused with those of *sexualis* but may be separated by the characters given in the key.

Dicerca sexualis Crotch

Figs. 52, 86, 102; Map 9

Dicerca sexualis Crotch, 1873:87; Chamberlin 1926:195; Barr 1971:59; Nelson 1975:108.

Description. Dark coppery to almost black dorsally and ventrally, more shining and with purple cast on ventral surface and on legs, dorsal surface with prominent, smooth, elongate, elevated, black areas. Head flattened; surface coarsely, rugosely punctured with two longitudinal, elevated calli on vertex and transverse, elevated callus between eyes, punctured areas sparsely clothed with semirecumbent, white setae. Antennae as in *tenebrosa*. Pronotum coarsely, rugosely punctured; median channel and smooth, elevated areas as in *tenebrosa* but more distinct; setae sparse, white, inconspicuous. Elytra as in *tenebrosa* but tapering more abruptly to slightly emarginate, less prolonged apices; disc densely punctured, strial punctures larger; interstriae bearing strongly elevated, longitudinal, smooth, black areas; basal and succeeding elevated areas of third interstriae connected by a raised ridge. Ventral surface as in *tenebrosa* except median concavity not as broad, setae not so coarse or extensive, and mesofemur not bearing dense setae beneath; apex of last visible abdominal sternite emarginate (♂) or acutely entire (♀). Aedeagus as in Fig. 86. Length 14.0-17.5 mm (♂); 12.3-20.0 mm (♀).

Hosts. Known from knobcone pine (*Pinus attenuata*), ponderosa pine (*P. ponderosa*), Jeffrey pine (*P. jeffreyi*), and Douglas-fir (*Pseudotsuga menziesii*).

Distribution. Southern British Columbia, and Pacific Coast states from Washington to southern California, east to Idaho and Nevada.

Comments. Adults of *sexualis* apparently display less variation in color than do adults of most species in this genus. They vary from coppery to almost black and the elytral apices may be simply truncate.

Adults of this species are similar to those of *crassicollis* but may be distinguished by the characters given in the key and in the description.

Dicerca lugubris LeConte

Figs. 87, 105; Map 9

Dicerca lugubris LeConte, 1860:200; Chamberlin 1926:187; Nelson 175:110.

Dicerca lacustris LeConte, 1860:202.

Dicerca morio Casey, 1909:156.

Dicerca lugubris austera Casey, 1909:157.

Description. Dark coppery to black dorsally, coppery ventrally. Head flattened; surface coarsely, rugosely punctured with two irregular, longitudinal, elevated areas on vertex and a transverse, elevated area between eyes, punctured areas with inconspicuous, semirecumbent, white setae. Antennae as described for *tenebrosa*. Pronotum flattened; disc densely, confluently punctured, strongly sculptured with four longitudinal, smooth, black, elevated areas, lateral pair interrupted by oblique depression behind middle; median channel broad, more impressed anteriorly and posteriorly; short, white setae inconspicuous. Elytra wider at base than pronotum; apices distinctly produced and entire; disc finely, densely punctured, strial punctures larger, surface with numerous, smooth, black areas. Ventral surface with sternites coarsely, densely punctured; prosternal process slightly concave without smooth, raised margins, concavity extending to anterior part of first abdominal sternite and moderately clothed with short, semirecumbent, white setae; mesotibia simple; abdominal sternites confluently punctured laterally, punctures smaller and less dense medially; apex of last visible abdominal sternite emarginate (♂) or entire (♀). Aedeagus as in Fig. 87. Length 11.1-16.5 mm (♂); 11.1-18.0 mm (♀).

Hosts. Larval host unknown. Adults have been taken on jack pine (*Pinus banksiana*) in Saskatchewan and Minnesota.

Distribution. Eastern Canada from New Brunswick to the Northwest Territories, and in the Lake states to Iowa.

Comments. This species is uniform in appearance but may vary from coppery to black above and the punctured areas may have pruinescence in fresh specimens.

Adults of *lugubris* are most often confused with those of *punctulata* but may be distinguished by the more strongly expanded pronotal margins, by the more distinctly prolonged elytral apices, and by the much more northerly distribution.

Dicerca punctulata (Schoenherr)

Figs. 88, 104; Map 10

Buprestis punctulata Schoenherr, 1817:123.

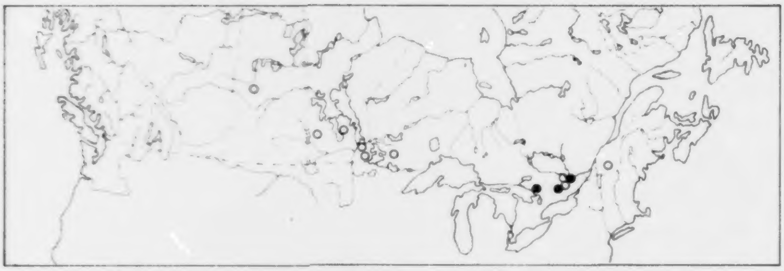
Dicerca punctulata: Knull 1925:15; Chamberlin 1926:194; Craighead 1950:195; Nelson 1975:112.

Buprestis transversa Say, 1825:249.

Dicerca punctulata pinorum Casey, 1909:154.

Description. Dark coppery to black dorsally and ventrally, more shining on ventral surface. Head flattened; surface coarsely, rugosely punctured with two weak, longitudinal, elevated areas on vertex, and a strongly transverse, elevated area between eyes, punctured areas sparsely clothed with inconspicuous, semirecumbent, white setae. Antennae as described for *tenebrosa*. Pronotum flattened; disc densely, confluently punctured, with four longitudinal, smooth, elevated areas, posterior pair interrupted by oblique depression behind middle; median channel weakly impressed; setae sparse and inconspicuous. Elytra wider at base than pronotum; apices slightly produced; entire; disc finely, densely punctured, strial punctures larger and oblong; surface with numerous, inconspicuous, elongate, black areas. Ventral surface coarsely, densely punctured; prosternal process with concave punctate channel having smooth, raised margins, channel with moderately abundant, semierect, white setae; mesotibia simple; abdominal sternites densely punctured laterally, less dense medially; apex of last visible abdominal sternite emarginate (♂) or entire (♀). Aedeagus as in Fig. 88. Length 9.0-14.8 mm (♂); 9.6-16.7 mm (♀).

Hosts. Known from shortleaf pine (*Pinus echinata*), pitch pine (*P. rigida*), eastern white pine (*P. strobus*), and loblolly pine (*P. taeda*).



Map 10. Collection localities of *Dicerca punctulata* (•) and *D. dumolini* (○).

Distribution. Ontario through the eastern United States, west to eastern Texas and Iowa.

Comments. Adults of *punctulata* may vary from coppery to nearly black and the punctured areas may bear pruinescence in fresh specimens. The elytral apices may be variably produced.

Adults of this species are similar to those of *lugubris* but are distinguished by the much more southerly distribution, by the weakly extended elytral apices, and by the weakly expanded (or not expanded) lateral margins of the pronotum.

Dicerca dumolini (Gory & Laporte)

Figs. 89, 103; Map 10

Buprestis dumolini Gory and Laporte, 1841:98.
Dicerca dumolini: Nelson 1975:115.
Dicerca consobrina Melsheimer, 1845:145.

Description. Brassy brown with irregular, strongly elevated, smooth, black areas, more coppery ventrally. Head flattened; surface coarsely, roughly punctured with three smooth, raised areas between eyes and two longitudinal areas on vertex, punctured areas sparsely clothed with short, recumbent, white setae. Antennae extending to middle of pronotum at sides, third segment distinctly longer than second segment. Pronotum densely, rugosely punctured with scattered, sparse, inconspicuous, white setae; longitudinal, smooth, elevated area extending from base to apex, interrupted at middle on each side of distinct median channel; longitudinal, smooth, elevated area interrupted midway to lateral margin by an oblique punctate depression. Elytra wider at base than pronotum; apices feebly produced and entire; disc densely, rugosely punctured, with numerous, irregular, smooth, black areas, with inconspicuous, white setae; striae indistinct but with some larger punctures on surface. Ventral surface densely, rugosely punctured; prosternal process concave, concavity densely punctured and extending to anterior part of first abdominal sternite; mesotibia simple; abdominal sternites densely, rugosely punctured, punctures with recumbent, white setae; apex of last visible abdominal sternite emarginate (♂) or acutely entire (♀). Aedeagus as in Fig. 89. Length 13.8–14.7 mm (♂); 14.1–16.5 mm (♀).

Hosts. Known from balsam fir (*Abies balsamea*), spruce (*Picea* spp.), and pine (*Pinus* spp.).

Distribution. Saskatchewan to Quebec, south through the northeastern United States to Virginia.

Comments. Adults are generally uniformly brassy brown, with the elevated areas black. They resemble adults of *tuberculata*, *lugubris*, and *punctulata*, but those of *dumolini* may be distinguished by the coarsely sculptured body surface and by the color.

Nelson et al. (1981) report a male 11.0 mm long and 4.5 mm wide from Quebec; it is almost 3 mm shorter than the previously reported minimum size. The small size is perhaps due to environmental conditions.

Dicerca tuberculata (Gory & Laporte)

Figs. 90, 106; Map 11

Buprestis tuberculata Gory and Laporte 1841:99.

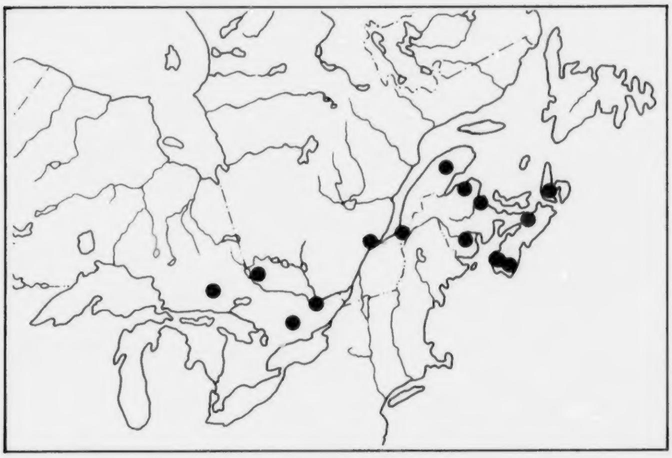
Dicerca tuberculata: Knull 1925:15; Chamberlin 1926:199; Craighead 1950:195; Nelson 1975:117.

Dicerca scobina Chevrolat, 1838:66.

Dicerca hilaris LeConte, 1860:200.

Dicerca manca LeConte, 1860:201.

Description. Greenish to coppery dorsally and ventrally, with numerous black, smooth areas on dorsal surface. Head flattened; surface coarsely, rugosely punctured with elevated areas on frons and two longitudinal, elevated areas on vertex, punctured areas sparsely clothed by short, recumbent, white setae. Antennae reaching to beyond middle of pronotum at sides, third segment distinctly longer than second segment. Pronotum densely punctured; median channel distinct with small, irregular, smooth area at middle and longitudinal, smooth, elevated area on either side of channel extending from base to apex; longitudinal, smooth, elevated area located midway to lateral margins and interrupted by oblique depression; irregular, elevated areas extending forward from basal angle; setae white, short, recumbent, and inconspicuous, sometimes absent. Elytra wider at base than pronotum; apices entire, slightly produced; disc densely, rugosely punctured, strial punctures larger, intervals with numerous, irregular, smooth, black, elevated areas becoming carinate toward apices; punctate areas sparsely clothed by short, white setae. Ventral surface densely, rugosely punctured; prosternal process moderately concave, concavity extending to anterior part of first abdominal sternite; mesotibia simple; abdominal sternites moderately punctured, rugose



Map 11. Collection localities of *Dicerca tuberculata*.

laterally, and with inconspicuous, recumbent, white setae; apex of last visible abdominal sternite emarginate (♂) or acutely entire (♀). Aedeagus as in Fig. 90. Length 14.7–19.0 mm (♂); 13.0–19.0 mm (♀).

Hosts. Known from balsam fir (*Abies balsamea*), tamarack (*Larix laricina*), spruce (*Picea* spp.), jack pine (*Pinus banksiana*), northern white cedar (*Thuja occidentalis*), and eastern hemlock (*Tsuga canadensis*). Probably occurs in all coniferous tree species in its range.

Distribution. Ontario to Nova Scotia, eastern United States, south to North Carolina.

Comments. Adults of this species vary mostly in the coloration of the punctured areas, which are usually coppery toward the midline above and iridescent green laterally but may be uniformly coppery or uniformly green. The sculpturing is fairly uniform, and the lateral margins of the pronotum may be more strongly expanded in some specimens.

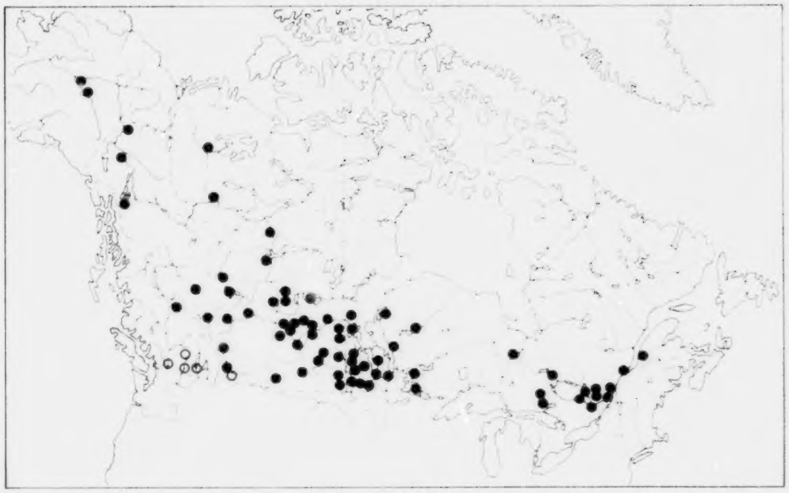
Adults closely resemble those of *dumolini* but differ as mentioned under that species.

Knull (1922) reports that this species breeds in the dry wood surrounding injuries on living trees.

Dicerca callosa callosa Casey

Figs. 33, 91, 108; Map 12

Dicerca callosa Casey, 1909:150; Barr 1971:60; Nelson 1975:122.
Dicerca callosa callosa: Nelson 1975:122.
Dicerca tetrica Casey, 1909:151.



Map 12. Collection localities of *Dicerca callosa callosa* (•) and *D. c. frosti* (○).

Description. Bronzy to coppery black dorsally, more distinctly brassy or coppery ventrally, with small, inconspicuous, black, elevated areas on elytra. Head flattened; surface coarsely, rugosely punctured, with moderately long, semierect, white setae. Antennae reaching middle of pronotum at sides, second and third segments subequal in length, seventh as long as wide. Pronotum strongly convex, coarsely, confluently punctured with pair of longitudinal, elevated areas extending from base to anterior margin, these separated by distinctly punctured median channel; another pair of longitudinal, weakly elevated areas located midway to lateral margin, interrupted by oblique depression and an irregular, elevated area near lateral margins; setae inconspicuous. Elytra wider at base than pronotum; apices entire, distinctly produced; disc confluently punctured over much of surface, strial punctures larger; striae distinct, especially toward suture; interstriae with numerous, irregular, and inconspicuous, black, elevated areas becoming carinate toward apices. Ventral surface densely, rugosely punctured; prosternal process transversely rugose, longitudinally concave, with smooth, lateral margins, concavity with dense, white setae; mesotibia with slight dilation on inner margin but no tooth (♂) or simple (♀); abdominal sternites rugosely punctured; apex of last visible abdominal sternite emarginate (♂) or tridentate (♀). Aedeagus as in Fig. 91. Length 12.5–20.0 mm (♂); 12.3–18.5 mm (♀).

Hosts. Recorded from quaking aspen (*Populus tremuloides*). Also taken on eastern white pine (*Pinus strobus*) but this is probably not a host plant.

Distribution. Transcontinental, from central Alaska to Quebec, and in the Lake states.

Comments. Adults vary from bronzy to coppery black, and the elytral apices may be only moderately produced.

Adults of this species most closely resemble those of *tenebrica* and *hesperoborealis* but may be distinguished by the lack of a tooth on the inner margin of the mesotibia of the male and by the more convex pronotum.

Dicerca callosa frosti Nelson

Fig. 109; Map 12

Dicerca frosti Nelson 1963:65; Barr 1971:60.
Dicerca callosa frosti: Nelson 1975:125.

Description. Adults similar to those of *D. callosa callosa* but slightly larger.

Hosts. Taken from quaking aspen (*Populus tremuloides*).

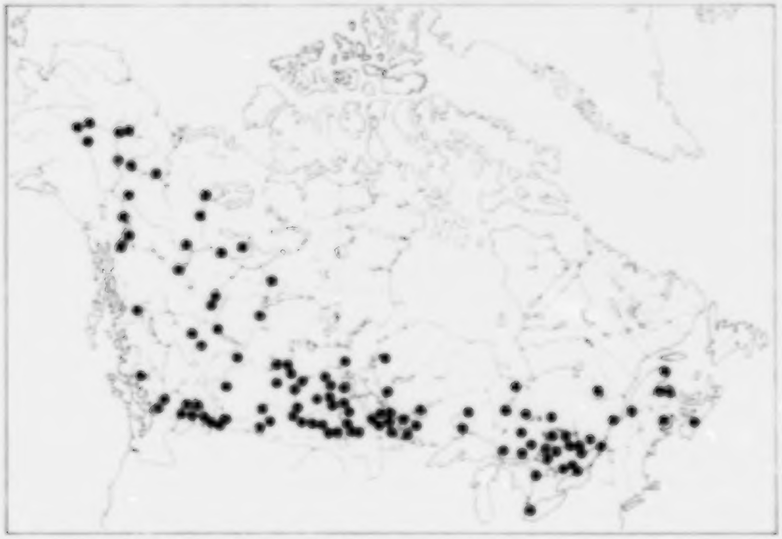
Distribution. Southern British Columbia and Alberta, through the western United States.

Dicerca tenebrica (Kirby)

Figs. 53, 92, 112; Map 13

Buprestis tenebrica Kirby, 1837:155.
Dicerca tenebrica: Chamberlin 1926:197; Craighead 1950:195; Barr 1971:60; Nelson 1975:126.
Dicerca prolongata LeConte, 1860:194.
Dicerca subcuprea Casey, 1909:147.
Dicerca subcuprea pertinax Casey, 1909:147.
Dicerca sulcatula Casey, 1909:147.
Dicerca subargentea Casey, 1909:148.
Dicerca severa Casey, 1909:149.
Dicerca prolongata longipennis Casey, 1909:150.

Description. Brassy to black, sometimes with bluish tint dorsally, coppery ventrally, with small, inconspicuous, black areas on elytra. Head flattened; surface coarsely, rugosely punctured with irregular, smooth, elevated areas, punctured areas bearing moderately long, semierect, white setae. Antennae reaching middle of pronotum at sides. Pronotum coarsely, confluently punctured, especially laterally; median channel distinct, punctured, extending from base to anterior margin; pair of longitudinal, smooth, elevated areas border channel, another less distinct elevated area located midway to lateral margin, interrupted by oblique depression behind middle; setae inconspicuous. Elytra wider at base than pronotum; apices entire, moderately



Map 13. Collection localities of *Dicerca tenebrica*.

to strongly produced; striae impressed on disc; interstriae elevated, smooth and interrupted by confluently punctured areas, elevated areas not prominent, carinate apically. Ventral surface densely, rugosely punctured; prosternal process strongly concave, with transverse rugae and smooth, elevated, lateral borders, concavity clothed with dense, white setae; mesotibia with internal tooth (♂) or simple (♀); abdominal sternites rugosely punctured; last visible abdominal sternite emarginate (♂) or tridentate (♀). Aedeagus as in Fig. 92. Length 15.0-21.5 mm (♂); 14.5-26.0 mm (♀).

Hosts. Known from *Populus* spp. Collected on black cottonwood (*P. trichocarpa*), quaking aspen (*P. tremuloides*), and narrowleaf cottonwood (*P. augustifolia*) and recorded from bigtooth aspen (*P. grandidentata*).

Distribution. Transcontinental throughout Canada and the United States except rare in the southeastern United States.

Comments. Little variation has been noted, even though this species is widely distributed and occurs in a variety of habitats. The usual brassy coppery color may be darkened in some specimens with a bluish tint or may be almost black.

Adults of this species resemble those of *divaricata* and *hesperoborealis* but can be distinguished by the characters given in the key.

Dicerca hesperoborealis Hatch & Beer

Figs. 93, 110; Map 14

Dicerca hesperoborealis Hatch and Beer, 1938:151; Barr 1971:59; Nelson 1975:129.

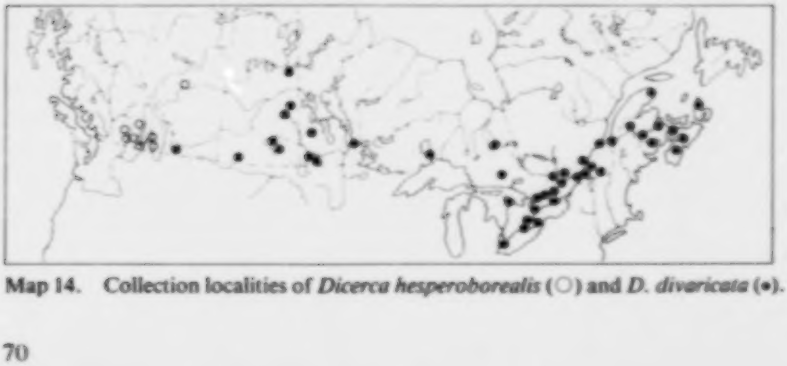
Description. Brassy to coppery dorsally, elytral tips and ventral surface distinctly coppery; small, elevated, black areas on elytra inconspicuous. Head flattened, frons and vertex slightly impressed at middle; surface coarsely, rugosely punctured with irregular, elevated, smooth areas, punctured areas bearing moderately long, semierect, white setae. Antennae as in *tenebrica*. Pronotum coarsely, confluently punctured, especially on lateral areas; median channel more impressed near anterior and posterior margins; pair of longitudinal, smooth areas border channel, another longitudinal, elevated area located midway to lateral margin and interrupted by oblique depression behind middle, and variable, elevated area located anterior to basal angles; setae inconspicuous. Elytra wider at base than pronotum; apices strongly produced, entire; striae impressed, especially toward suture; interstriae elevated, smooth, and interrupted by confluently punctured areas, elevated areas not prominent, carinate apically. Ventral surface as in *tenebrica* except prosternal concavity bears sparse, short, white setae and median carina of antecoxal piece bears a strong median groove. Aedeagus as in Fig. 93. Length 16.5–20.0 mm (♂); 15.5–20.0 mm (♀).

Hosts. Known from birch (*Betula* spp.) and alder (*Alnus* spp.).

Distribution. British Columbia and Alberta to northern California, east to Idaho, Nevada, and Utah.

Comments. Adults of this western species vary from brassy to coppery to dark coppery; otherwise specimens show little variation.

This species is readily distinguished by the deep median groove on the antecoxal piece; otherwise adults closely resemble those of *tenebrica*, *divaricata*, and *callosa*.



Map 14. Collection localities of *Dicerca hesperoborealis* (○) and *D. divaricata* (•).

Dicerca divaricata (Say)

Figs. 94, 113; Map 14

Buprestis divaricata Say, 1823:163.

Dicerca divaricata: Knull 1925:11; Chamberlin 1926:183; Craighead 1950:195; Nelson 1975:131.

Dicerca dubia Melsheimer, 1845:142.
Dicerca aurichalcea Melsheimer, 1845:142.
Dicerca parumpunctata Melsheimer, 1845:143.
Dicerca subaequalis Casey, 1909:143.
Dicerca divaricata limula Casey, 1909:144.
Dicerca divaricata incisa Casey, 1909:144.
Dicerca aestiva Casey, 1909:146.
Dicerca rustica Casey, 1909:146.
Dicerca vancouveri Casey, 1909:148.

Description. Brassy to coppery or with a greenish tint dorsally and ventrally, elytral tips more distinctly coppery; small, elevated, black areas on elytra inconspicuous. Head flattened; surface coarsely, rugosely punctured, with small, irregular, smooth, elevated areas, punctured areas bearing moderately long, semierect, white hair. Antennae similar to *tenebrica*. Pronotum coarsely, confluently punctured, especially laterally; median channel weakly impressed and bordered by elongate, smooth areas, another vague, elongate, smooth area located midway to lateral margin, interrupted by oblique depression behind middle and other irregular, elevated areas located near lateral margins; setae inconspicuous. Elytra wider at base than pronotum; apices distinctly produced, truncate, entire; striae impressed, especially near suture; interstriae with numerous, inconspicuous, black, elevated areas, carinate apically. Ventral surface as in *tenebrica* except carina on antecoxal piece bearing a narrow, median groove. Aedeagus as in Fig. 94. Length 15.0–20.0 mm (♂); 15.1–22.0 mm (♀).

Hosts. Breeds in a variety of deciduous trees. Reared or collected from maple (*Acer* spp.); birch (*Betula* spp.), eastern redbud (*Cercis canadensis*), ash (*Fraxinus* spp.), eastern hop hornbeam (*Ostrya virginiana*), *Prunus* spp., oak (*Quercus* spp.), and American elm (*Ulmus americana*).

Distribution. Eastern Canada, extending west to central Alberta, and in the eastern United States west to North Dakota and south to eastern Texas and northern Alabama and Georgia. Nelson (1975) records one record from southern Utah. Casey (1909) described *vancouveri* from Vancouver, B.C., but the specimens were probably mislabeled.

Comments. Adults of *divaricata* vary from bright brassy or greenish brassy to dark coppery. The median channel on the pronotal disc is usually weakly impressed but may be moderately developed.

Adults of *divaricata* closely resemble those of the preceding three species but may be distinguished by the characters given in the key and by the remarks given for the other three species.

Knull (1922) reports that this species breeds in the heartwood of a variety of dead trees.

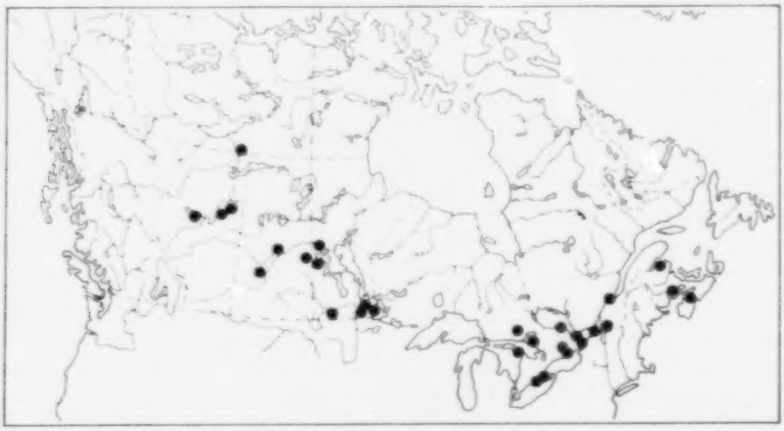
Dicerca caudata LeConte

Figs. 95, 111; Map 15

Dicerca caudata LeConte, 1860:195; Knull 1925:12; Chamberlin 1926:131; Craighead 1950:195; Nelson 1975:135.
Dicerca abrupta Casey, 1909:140.
Dicerca biangulata Casey, 1909:140.
Dicerca inflatula Casey, 1909:140.
Dicerca pisciformis Casey, 1909:141.
Dicerca pisciformis longicauda Casey, 1909:141.
Dicerca cupreola Casey, 1909:141.
Dicerca cupreola filiola Casey, 1909:142.

Description. Coppery to nearly black dorsally, more strongly coppery on ventral surface and on elytra tips; small, black, elevated areas on elytra inconspicuous. Head and antennae as described for *divaricata*. Pronotum convex, coarsely, roughly punctured, especially laterally, with smooth, longitudinal, elevated areas bordering median channel, another elevated area located midway to lateral margin and other irregular, elevated areas located near lateral margin; setae inconspicuous. Elytra wider at base than pronotum; apices strongly produced, truncate, entire and divaricate; striae weakly impressed; interstriae bearing numerous, inconspicuous, black, elevated areas, carinate apically. Ventral surface as in *hesperoborealis*; mesotibia with internal tooth (♂) or simple (♀); apex of last visible abdominal sternite emarginate with a broad, short, rectangular projection (♂) or tridentate (♀). Aedeagus as in Fig. 95. Length 14.0–18.0 mm (♂); 13.0–19.0 mm (♀).

Hosts. Known from alder (*Alnus* spp.), birch (*Betula* spp.), and *Prunus* spp. Probably occurs on a wide variety of deciduous trees.



Map 15. Collection localities of *Dicerca caudata*.

Distribution. Eastern Canada, extending west to Alberta and Northwest Territories, and in the eastern United States west to Utah, Arizona, and South Dakota, and south to Louisiana.

Comments. Adults of this species vary from coppery to almost black and the elytral apices may not be divaricate or only slightly so.

This species is similar in appearance to *divaricata* but may be distinguished (with difficulty) by the characters given in the key. Both species have essentially the same distribution and host plants.

Dicerca pugionata (Germar)

Figs. 96, 114

Buprestis pugionata Germar, 1824:37.

Dicerca pugionata: Knull 1925:13; Chamberlin 1926:13; Craighead 1950:195; Nelson 1975:139.

Description. Coppery to black dorsally, more distinctly so toward elytral apices and on ventral surface; elongate, black, elevated areas on elytra distinct. Head flattened; surface rugosely punctate, rugae mainly longitudinal; setae short and sparse. Antennae short, not reaching middle of pronotum, outer segments short and broad. Pronotum convex, coarsely punctured, becoming rugose laterally; median channel more impressed anteriorly and posteriorly; surface with two pairs of longitudinal, smooth, elevated areas and smaller, elevated areas near lateral margin; setae short, white, inconspicuous. Elytra slightly wider at base than pronotum; elytral apices usually prolonged, bidentate; striae evident medially, randomly placed laterally; interstriae with many smooth, black, elevated areas, carinate toward apices. Ventral surface coarsely punctured, especially laterally; thoracic sternites with longitudinal, smooth, largely impunctate areas bordering the punctate, setose median concave channel, concavity extending from prosternum to anterior portion of first abdominal sternite; mesotibia simple in both sexes; apex of last visible abdominal sternite emarginate, with short, rectangular projection (♂) or tridentate (♀). Aedeagus as in Fig. 96. Length 11.0–14.8 mm (♂); 11.3–15.0 mm (♀).

Hosts. Reared from witch-hazel (*Hamamelis virginiana*) and ninebark (*Physocarpus opulifolius*). Collected on speckled alder (*Alnus rugosa*).

Distribution. Ontario, south to Georgia, USA.

Canadian record. Stittsville, Ont.

Comments. Adults of *pugionata* vary from coppery to almost black; otherwise specimens show little variation.

Unlike other species in the genus, this species is reported to attack and kill healthy trees.

D. pugionata is a distinctive species in which the adults are similar to *caudata* in general fasciae but are readily distinguished by the prolonged bidentate elytral tips, by the small size, and by the bright coppery color.

Dicerca lurida (Fabricius)

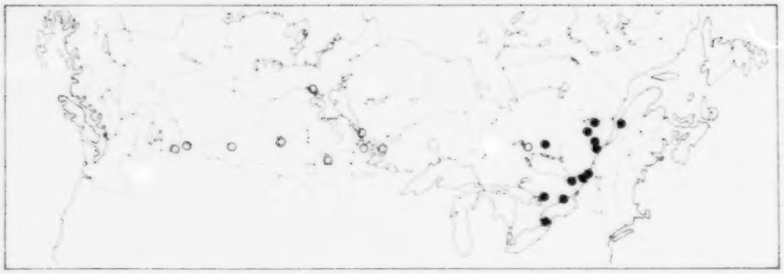
Figs. 97, 118; Map 16

Buprestis lurida Fabricius, 1775:217.
Dicerca lurida: Knull 1925:12; Chamberlin 1926:187; Craighead 1950:195; Nelson 1975:152.
Buprestis pruinosa Gory, 1841:109.
Dicerca indistincta Melsheimer, 1845:143.
Dicerca pruinosa LeConte, 1873:331.
Dicerca indurata Casey, 1909:131.
Dicerca truncata Casey, 1909:132.
Dicerca gracilis Casey, 1909:133.
Dicerca porcatula Casey, 1909:133.
Dicerca innocua Casey, 1909:133.
Dicerca sogax Casey, 1909:134.
Dicerca floridae Casey, 1909:134.
Dicerca soror regularis Casey, 1909:135.
Dicerca levettei Casey, 1909:135.
Dicerca gaudens Casey, 1909:136.
Dicerca seriata Casey, 1909:136.
Dicerca erosa Casey, 1909:137.

Description. Brassy to coppery dorsally and ventrally, sometimes with greenish reflections; small, black, elevated areas on elytra inconspicuous. Head flattened; surface coarsely, roughly punctured, with irregular, smooth callosities on frons and vertex; punctures bearing inconspicuous, white setae. Antennae short, not reaching middle of side of pronotum. Pronotum strongly to evenly convex, densely punctured, punctures larger laterally; median channel feebly indicated anteriorly and posteriorly; faintly indicated longitudinal, smooth areas located in middle and halfway to lateral margin, smaller callosities located near lateral margin. Elytra wider at base than pronotum; apices short and bidentate; disc with strial punctures more numerous medianly, punctured areas more extensive laterally, bearing short, inconspicuous, white setae. Ventral surface coarsely punctured laterally, with smooth, sparsely punctured areas bordering the finely, densely punctured and setose median concave channel, concavity extending from prosternum to anterior portion of first abdominal sternite; mesotibia simple in both sexes; last visible abdominal sternite emarginate, with short, rectangular projection (♂) or tridentate (♀). Aedeagus as in Fig. 97. Length 12.0–18.0 mm (♂); 11.8–20.0 mm (♀).

Hosts. Various deciduous trees. Recorded from alder (*Alnus* spp.), hornbeam (*Carpinus* spp.), hickory (*Carya* spp.), oak (*Quercus* spp.), willow (*Salix* spp.), and basswood (*Tilia* spp.).

Distribution. Ontario and Quebec, and in the eastern United States, west to Kansas and Oklahoma, and south to western Texas.



Map 16. Collection localities of *Dicerca lurida* (•) and *Poecilonota ferrea* (○).

Comments. Adults of this species may vary from greenish coppery to dark coppery; otherwise specimens show little variation.

Among Canadian species, adults of *lurida* are distinctive. They may resemble those of *lepida* and *asperata* but should be readily separated by the characters given in the key.

Dicerca lepida LeConte

Figs. 98, 115

Dicerca lepida LeConte, 1857:7; Knull 1925:13; Chamberlin 1926:186; Nelson 1975:141.

Description. Brassy to coppery dorsally and ventrally; smooth, elevated, black areas on elytra conspicuous. Head flattened; surface rugosely punctured, bearing two longitudinal, elevated areas on vertex and an irregular, transverse, elevated area on frons with smaller elevated area below, punctured areas bearing short, white setae. Pronotum coarsely punctured, especially laterally; disc bearing three pairs of longitudinal, smooth, elevated areas, median pair broad, separated by punctate midline impression, middle pair narrowed or interrupted by depression behind middle, lateral pair irregular and interrupted; punctured areas bearing short, semirecumbent, white setae. Elytra wider at base than pronotum; apices weakly produced, bidentate; striae weakly indicated medianly, randomly punctured laterally; smooth, elevated areas predominate on disc toward suture and punctured areas predominate laterally; setae short, semirecumbent. Ventral surface coarsely punctured laterally, with smooth, sparsely punctured areas bordering the punctate, setose, median channel, concavity extending from prosternum to anterior portion of first abdominal sternite; mesotibia simple in both sexes; last visible abdominal sternite emarginate, with a short, rectangular projection (♂) or tridentate (♀). Aedeagus as in Fig. 98. Length 13.5–17.5 mm (♂); 14.0–16.5 mm (♀).

Hosts. Recorded from hawthorn (*Crataegus* spp.), hop hornbeam (*Ostrya* spp.), oak (*Quercus* spp.), and elm (*Ulmus* spp.).

Distribution. Not recorded from Canada but should occur in southern Ontario. Occurs in the eastern United States as far north as central New York.

Comments. Adults of *lepida* vary from brassy to coppery; otherwise specimens show little variation.

Adults of this species resemble those of *asperata*, but the transverse callosity between the eyes is only faintly indicated and the other body sculpture is less strongly indicated.

Dicerca asperata (Gory & Laporte)

Figs. 99, 116

Buprestis asperata Gory and Laporte, 1841:105.
Dicerca asperata: Nelson 1975:144.
Dicerca molitor Melsheimer, 1845:144.

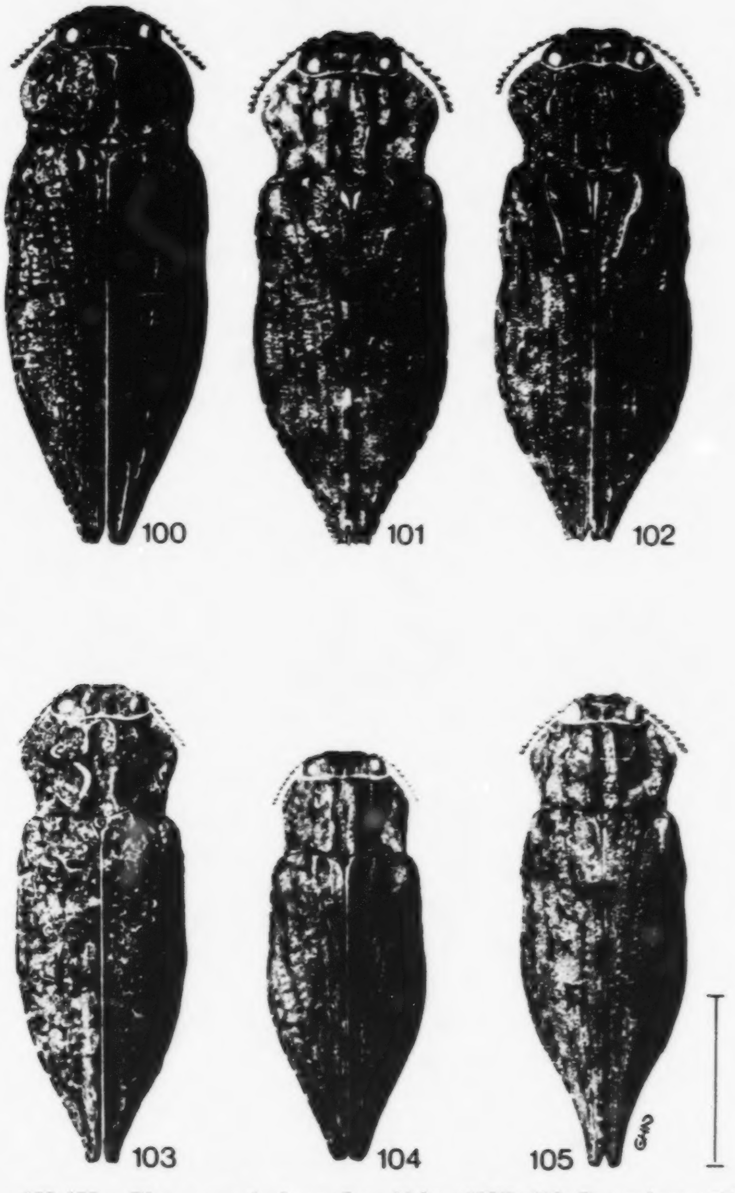
Description. Greenish brassy to black dorsally, coppery bronze ventrally; smooth, black, elevated areas on elytra distinct. Head flattened; surface coarsely, roughly punctured; transverse, elevated area between eyes strongly indicated, variously connected to two longitudinal areas on vertex; surface bearing short, semirecumbent, white setae. Antennae reaching middle of pronotal side. Pronotum moderately convex, coarsely, rugosely punctured, especially laterally; disc with depressions on each side posterior to middle and with longitudinal, smooth, elevated areas bordering median punctate area, another elevated area halfway to lateral margin interrupted by depression and additional irregular, elevated areas near lateral margin. Elytra wider than pronotum at base; apices feebly prolonged, bidentate; striae faintly evident on disc, randomly punctured laterally; smooth, black, elevated areas strongly evident; punctured areas less extensive laterally and bearing short, semirecumbent, white setae. Ventral surface coarsely, rugosely punctured laterally, punctures smaller medially; prosternal process with median longitudinal concavity weak and bearing sparse punctures and setae, concavity more evident on anterior portion of first abdominal sternite; mesotibia simple in both sexes; last visible abdominal sternite emarginate, with short, broad, rectangular projection (♂) or tridentate (♀). Aedeagus as in Fig. 99. Length 12.3–17.5 mm (♂); 12.3–18.5 mm (♀).

Hosts. Recorded from oak (*Quercus* spp.).

Distribution. Not recorded from Canada but should occur in southern Ontario. Occurs in the eastern United States as far north as southern Michigan and Buffalo, NY.

Comments. Adults of this species are brassy with a definite greenish cast but may be darker; otherwise specimens show little variation.

Adults of *asperata* resemble those of *lepida* but are easily distinguished by the characters given in the key.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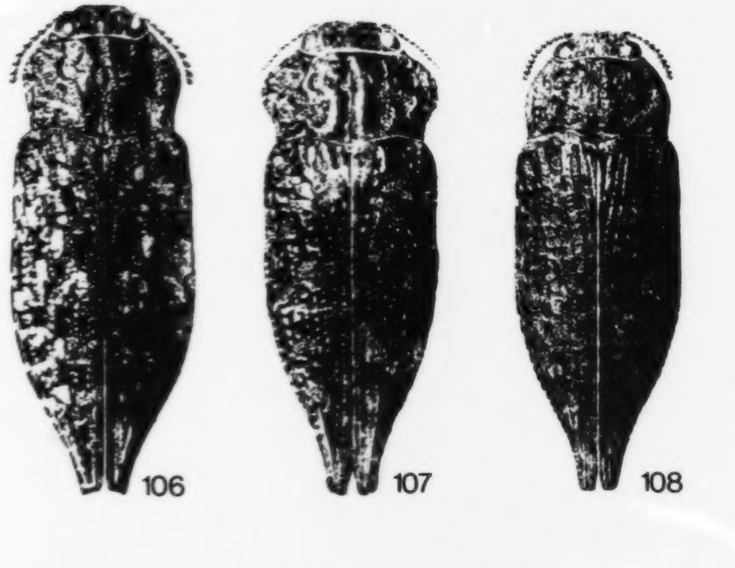
Figs. 100–105. *Dicerca* spp. (redrawn from Nelson 1975). 100, *D. tenebrosa*; 101, *D. crassicollis*; 102, *D. sexualis*; 103, *D. dumolini*; 104, *D. punctulata*; 105, *D. lugubris*.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Figs. 106–111. *Dicerca* spp. (redrawn from Nelson 1975). 106, *D. tuberculata*; 107, *D. pectorosa*; 108, *D. callosa callosa*; 109, *D. callosa frosti*; 110, *D. hesperoborealis*; 111, *D. caudata*.

Genus *Poecilonota* Eschscholtz

Members of this genus can be recognized by the transverse scutellum, which is broader than long, by the prolonged elytral apices, by the prosternum, which widens behind the procoxae, and by the median longitudinal ridge on the pronotum. *Poecilonota* has been confused with *Buprestis* and *Dicerca*, but is readily separated from these genera by its oblique eyes, by the single, impunctate pronotal carina, by the broad scutellum, and by the dark coloration. Additional distinctive characteristics are the serriform antennae (Fig. 15), the striate elytra (Fig. 117), the dilated metacoxae, and the elongate first tarsal segment.

The habits of species of *Poecilonota* are not well known. *Populus* spp., seem to be the preferred host, with *Salix* spp., also highly favored. Adult beetles have been collected from alder, oak, pine, sycamore, tamarack, and wild flowers; however, none of these is the larval host plant.

In general, the larvae feed under the bark of wounds on living poplar trees and remain there for 2 years. The larval galleries are not extensive and pupation occurs under the bark. Species of *Poecilonota* are of only minor economic importance.

Description. Body narrowly subelliptic, moderately convex; violet to gray brown. Head concave in front with irregular, median, dorsal carina frequently in form of inverted Y; clypeus concave, arcuately emarginate; eyes large, elliptic, convex, inner margins straight. Antennal segments slightly flattened, with sparse, short pubescence, first segment subovate, usually different color from remaining segments, second segment small, subglobose, third segment slightly longer than first, slender, fourth segment as in third but larger, segments 5–11 becoming progressively shorter, serriform along inner margins, terminal segments subtriangular (Fig. 15). Pronotum usually wider than long; anterior margin slightly sinuate; lateral margin subarcuate; disc with a weakly elevated, moderately wide, smooth and impunctate median carina extending entire length, carina bordered laterally by a punctate depression; lateral areas slightly swollen, moderately punctate; submarginal areas impressed, densely punctate, frequently with large, irregular, depression posteriorly; hind angles obtusely rounded. Scutellum transverse, variable in shape, frequently subtrapezoid, often with median depression. Elytra slightly wider than pronotum, moderately tapered; apex variably prolonged beyond abdomen, arcuately emarginate but not toothed; disc with 11 pairs of costae of varying size and punctation, except short, scutellar costae (second interstriae at base), these usually less punctate; odd-numbered costae more prominent, sometimes less punctate; lateral surface with large, shallow, densely punctured foveae irregularly spaced and less obvious on disc; strial punctures small. Ventral surface finely punctured; prosternal process with sides arcuate, process widened behind procoxae. Inner margins of metacoxae strongly dilated. First abdominal sternite slightly longer than second with a shallow, median impression; sternites 2–4 subequal in length; fifth sternite subtriangular, apex with arcuate emargination.

Comments. This genus was revised by Evans (1957) who recognized eight North American species, five of which occur in Canada.

Key to species of *Poecilonota* in Canada

(Modified from Evans (1957) and Barr (1971))

1. Scutellar costae basally impunctate for a distance at least equal to scutellar width, never rugose; elytral apices deeply notched; pronotum frequently with irregular, smooth, elevated areas on both sides at middle; southwestern British Columbia .... ***fraseri* Chamberlin** (p. 81)

   Scutellar costae basally punctate and/or rugose; elytral apices notched or subtruncate; pronotum often without conspicuous, smooth, elevated areas on either side of middle 2

2. Lateral carinae of prosternal process terminating at anterior angles of procoxal cavities; elytral lateral margins subangulate; abdomen usually conspicuously pubescent; southeastern British Columbia to Quebec .... ***ferrea* (Melsheimer)** (p. 84)

   Lateral carinae of prosternal process extending past anterior angles of procoxal cavities and diverging slightly from them; elytral lateral margins sinuate; abdomen not conspicuously pubescent 3

3. Elytral apices prolonged, usually notched and divergent; sides of pronotum slightly arcuate, usually broadest behind middle; body width usually less than 39% of body length measured from anterior pronotal margin to elytral apices; transcontinental except absent in southwestern British Columbia .... ***cyanipes* (Say)** (p. 85)

   Elytral apices occasionally prolonged and divergent, usually subtruncate or oblique; sides of pronotum strongly arcuate, usually broadest at or before middle; body width usually more than 39% of body length measured as above 4

4. From southern Manitoba .... ***thureura* (Say)** (p. 86)

   From southern British Columbia .... ***montana* Chamberlin** (p. 88)

Tableau des espèces de *Poecilonota* du Canada

(modifiée de Evans (1957) et de Barr (1971))

1. Costae scutellaires lisses à la base sur une distance au moins égale à la largeur du scutellum, non rugueuses; apex de chaque élytre profondément échancré; pronotum souvent avec des zones soulevées lisses, irrégulières, de chaque côté du milieu; sud-ouest de la Colombie-Britannique . . ***fraseri* Chamberlin** (p. 81)

   Costae scutellaires ponctuées à la base et(ou) rugueuses; apex de chaque élytre échancré ou subtronqué; pronotum souvent sans zones soulevées lisses apparentes de chaque côté du milieu 2

2. Carènes latérales de la saillie prosternale se terminant aux angles antérieurs des cavités procoxales; marges latérales des élytres subangulaires; abdomen en général distinctement pubescent; sud-est de la Colombie-Britannique jusqu'au Québec .... ***ferrea* (Melsheimer)** (p. 84)

   Carènes latérales de la saillie prosternale dépassant les angles antérieurs des cavités procoxales et s'éloignant légèrement de celles-ci; marges latérales des élytres sinueuses; abdomen non distinctement pubescent 3

3. Apex de chaque élytre prolongé, généralement échancré et divergent; pronotum avec les côtés légèrement arqués, sa largeur maximale généralement située en arrière du milieu; largeur du corps en général moins de 39 % de la longueur

mesurée de la marge antérieure du pronotum à l'apex des élytres; transcontinental mais absent dans le sud-ouest de la Colombie-Britannique .... ***cyanipes* (Say)** (p. 85)

Apex de chaque élytre parfois prolongé et divergent, en général subtronqué ou oblique; pronotum avec les côtés très arqués, sa couleur maximale située au milieu ou en avant du milieu; largeur du corps en général plus de 39 % de la longueur 4

4. Espèce du sud du Manitoba .... ***thureura* (Say)** (p. 86)
Espèce du sud de la Colombie-Britannique .. ***montana* Chamberlin** (p. 88)

Poecilonota fraseri Chamberlin

Fig. 119

Poecilonota fraseri Chamberlin, 1922:64; Chamberlin 1926:228; Evans 1957:32; Barr 1971:60.

Description. Gray brown, with darker broken striation; labrum and antennae coppery; elytral apices faintly bronzed; pulverescence absent. Head with sparse pubescence; surface deeply, closely punctured, punctures large. Pronotum broadest in front at middle; sides strongly arcuate; disc with median line wide, evenly bordered by narrow, moderately punctate, longitudinal impression; lateral areas slightly swollen, less punctate; submarginal areas weakly, irregularly impressed, strongly, densely punctured. Elytra broader than pronotum; sides broadly arcuate on posterior two-thirds; apices slightly prolonged, narrow, weakly divergent, deeply notched; disc costate, costae moderately developed, convex; scutellar costae prominent, nearly impunctate; strial punctures small. Ventral surface densely, finely punctured; prosternal process with submarginal area impressed, densely punctured; apex of last visible abdominal sternite with large, broad emargination having lateral angles acute (♂) or with shallow, narrower emargination having lateral angles slightly rounded (♀). Aedeagus as in Fig. 119. Length 9.0–13.8 mm (♂); 10.6–15.8 mm (♀).

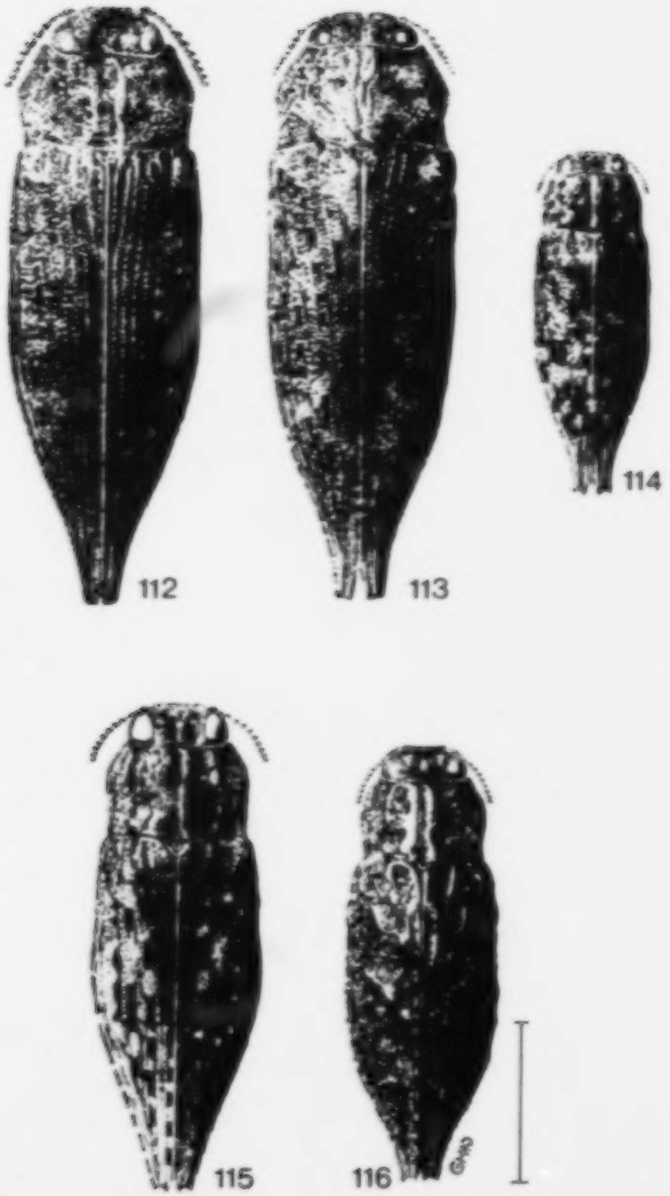
Hosts. Known from willow (*Salix* spp.).

Distribution. Southern Vancouver Island to northern California.

Canadian record. Southern Vancouver Island (Evans 1957).

Comments. This is the smallest of the Canadian *Poecilonota*, averaging 12.0 mm in length. The comparatively broad and flat form is accentuated by the broadly arcuate elytral margins that converge abruptly to the slightly recurved apices. The latter, although short, are prominently divergent, deeply notched, and faintly bronzed. The lateral margins of the elytra may also be slightly bronzed. The general body color is mottled gray but appears metallic brown on close observation. The antennae are nearly always coppery.

Nothing is known about the biology of this species other than its host.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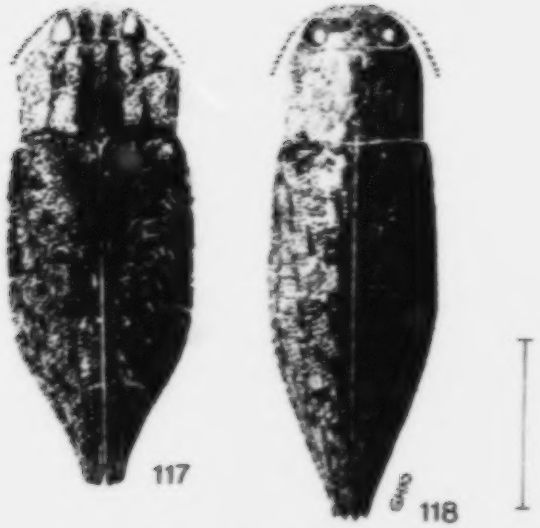
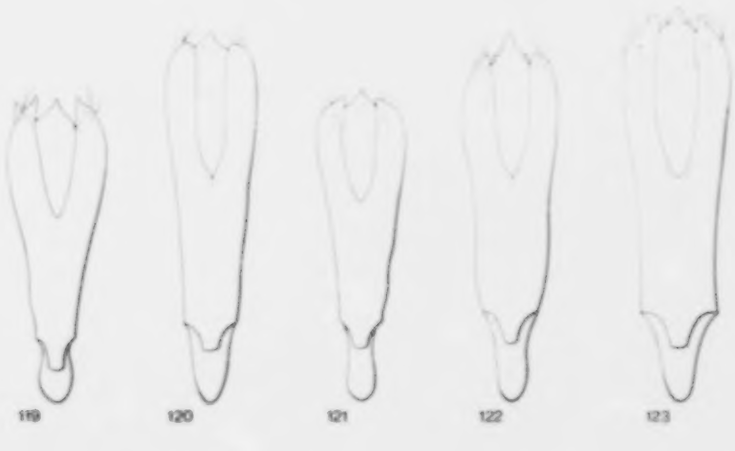
Figs. 112–116. *Dicerca* spp. (redrawn from Nelson 1975). 112, *D. tenebrica*; 113, *D. divaricata*; 114, *D. pugionata*; 115, *D. lepida*; 116, *D. asperata*.



Figs. 117, 118. *Dicerca* spp. (redrawn from Nelson 1975). 117, *D. hornii*; 118, *D. lurida*.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Figs. 119–123. Aedeagi of *Poecilonota*. 119, *P. fraseri*; 120, *P. ferrea*; 121, *P. cyanipes*; 122, *P. thureura*; 123, *P. montana*.

Poecilonota ferrea (Melsheimer)

Fig. 120; Map 16

Dicerca ferrea Melsheimer, 1845:144.
Poecilonota ferrea: Chamberlin 1926:228; Evans 1957:34; Barr 1971:60.

Description. Mottled gray, with slight tint of brown, slightly metallic; antennae coppery green; elytral tips slightly bronzed. Head deeply, coarsely punctured in impression and along inner eye margin. Pronotum widest at middle; sides broadly arcuate from base to apex; disc with median line narrow, margins irregular, bordered by irregular punctation; lateral areas irregularly swollen and punctate, depressed near posterior margin; submarginal areas densely punctate, slightly rugose. Elytra broader than pronotum; sides subparallel on anterior half, evenly converging posteriorly to apex; apices slightly prolonged and divergent, narrowly subtruncate, irregular but not dentate; disc irregularly punctate, punctures occasionally coalescing to form large, shallow fovea laterally; costae prominent, even, flat, moderately punctate; scutellar costae flat, sparsely punctate; strial punctures small, unevenly spaced. Ventral surface densely, deeply punctured; prosternal process with submarginal areas slightly depressed, moderately punctate; apex of last visible abdominal sternite arcuately emarginate, lateral angles slightly rounded (♂) or with shallow emargination, sometimes nearly absent (♀). Aedeagus as in Fig. 120. Length 12.0–16.0 mm (♂); 14.5–19.0 mm (♀).

Hosts. Possibly poplar (*Populus* spp.) and willow (*Salix* spp.) (see comments).

Distribution. Southeastern British Columbia to southern Quebec, and in the eastern United States, south to Florida, west to Kansas, Nebraska, and Texas.

Comments. The adults of this species are relatively large and the lateral margins of the elytra present a subangulate appearance rather than the sinuate outline of other species. The color is a mottled iron gray with a faint tint of brown and is only slightly metallic. The lighter patches of color are areas of greatest punctation. The elytral costae are well developed, especially near the elytral bases where fine reticulation or cross-striation may occur.

Evans (1957) and Barr (1971) report that the host for this species is not known. Chamberlin (1926) records quaking aspen (*Populus tremuloides*), and scouler willow (*Salix scouleriana*) as hosts. Specimens in the Canadian National Collection that are labeled *Populus tremuloides* and *Populus trichocarpa* have been examined. These specimens were evidently seen by Evans (1957) but no mention is made of them in his published revision of the genus.

Poecilonota cyanipes (Say)

Figs. 34, 121, 124; Map 17

Buprestis cyanipes Say, 1823:164.

Poecilonota cyanipes: Knull 1925:16; Chamberlin 1926:226; Craighead 1950:196; Evans 1957:28; Anderson 1966:254; Barr 1971:60.

Buprestis erecta Gory, 1841:110.

Poecilonota debilis LeConte, 1860:204.

Poecilonota cupripes Casey, 1909:169.

Poecilonota parviceps Casey, 1909:169.

Poecilonota apicalla Obenberger, 1928:181.

Poecilonota collaris Obenberger, 1928:181.

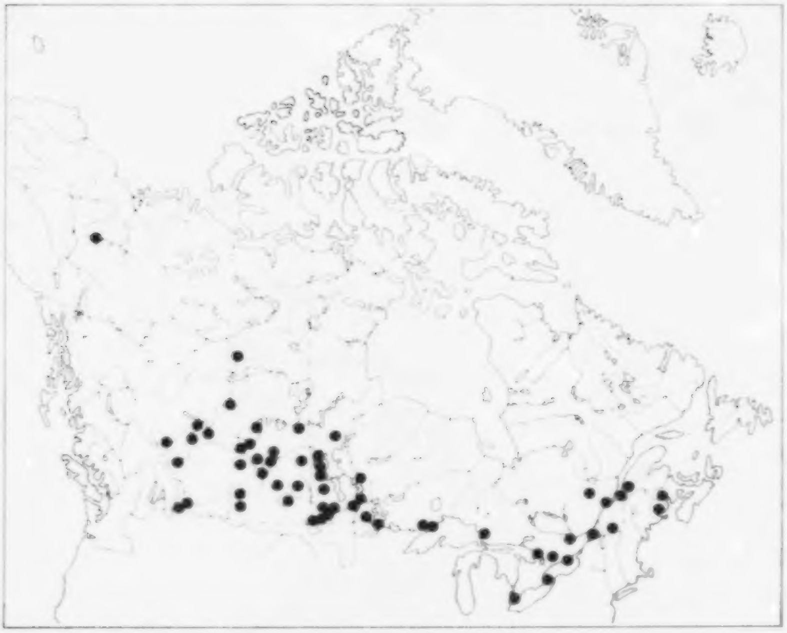
Description. Dark coppery gray; antennal scape coppery, remaining segments coppery green; elytral tips brightly bronzed. Head as in *ferrea*. Pronotum widest near middle; sides evenly, broadly arcuate from base to apex; disc with median line evenly margined, bordered by moderate punctation; lateral areas less punctate, slightly and irregularly swollen, slight impression near posterior margin; submarginal areas densely punctate. Elytra wider than pronotum, widest behind middle; sides subparallel, slightly sinuate on anterior one-third, posterior two-thirds tapering rapidly to apex, feebly sinuate; apices distinctly prolonged, moderately divergent, usually truncate, microspinulose; disc densely punctured, punctures small, usually placed in small patches that occasionally coalesce laterally into shallow foveae; costae moderately developed; scutellar costae slightly rounded, moderately punctate; strial punctures small, evenly spaced. Ventral surface densely, deeply punctured; prosternal process finely, moderately punctate, submarginal depression absent; apex of last visible abdominal sternite arcuately emarginate, lateral angles slightly rounded (♂) or with small, deep, subarcuate, emargination (♀). Aedeagus as in Fig. 121. Length 10.4–16.0 mm (♂); 10.0–18.0 mm (♀).

Hosts. Known from poplar (*Populus* spp.).

Distribution. East of the Pacific Coast mountain range from the Yukon Territory to western Alberta (and adjacent British Columbia), east across the continent to New Brunswick, and throughout the United States east of the Cascades, and Sierra Nevada from eastern Idaho to northern Arizona east except in the extreme southeastern states.

Comments. This is the most common and best known North American species of *Poecilonota*. Adults are most easily distinguished by the slender, flattened form, by the moderately prolonged, bronzed elytral apices, and by the slightly sinuate lateral margins of the pronotum.

Adults of this species select injured or decadent aspen, cottonwood, and ornamental poplars, and have been collected off oak, pine, and sycamore. In connection with its habit of boring in decaying wood, this species has been associated with the galls of the poplar borer *Saperda calcarata* Say and *S. concolor* LeConte in *Populus tremuloides* and *P. deltoides*, respectively.



Map 17. Collection localities of *Poecilonota cyanipes*.

Poecilonota thureura (Say)

Fig. 122

Buprestis thureura Say, 1832:3.

Poecilonota thureura: Knull 1925:16; Chamberlin 1926:226; Craighead 1950:196; Evans 1957:35.

Buprestis costicollis Gory, 1841:109.

Description. Mottled dark violet brown to green, punctures and foveae light coppery; antennal scape violet brown, other segments darker; elytral apices not bronzed. Head as in *ferrea*. Pronotum widest behind middle; sides slightly sinuate from base to apex; disc with median line evenly narrow, bordered by moderate punctation; lateral areas less punctate than densely punctate, slightly depressed submarginal areas. Elytra wider than pronotum, widest behind middle; sides arcuate; apices short, slightly divergent, irregularly emarginate; disc with foveae shallow, densely punctate, irregularly spaced; costae moderately punctate between foveae, slightly flattened, slightly rugose on base; scutellar costae sparsely rugose-punctate; strial punctures small and close. Ventral surface densely, deeply punctured; prosternal process sparse-

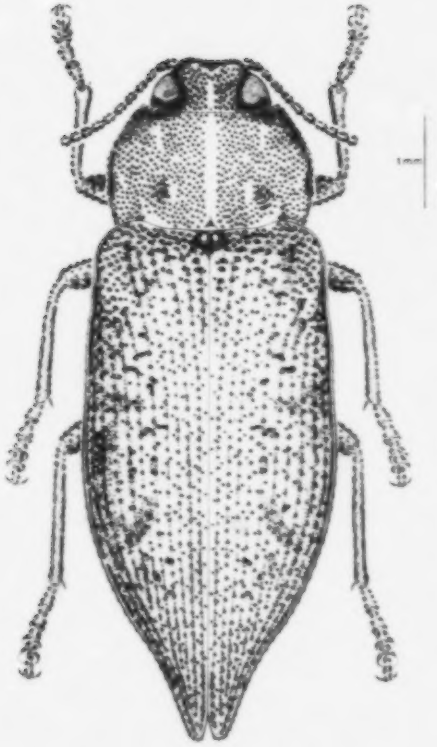


Fig. 124. *Poecilonota cyanipes.*

ly, finely punctate and pubescent, with slight submarginal depression anteriorly; apex of last visible abdominal sternite arcuately emarginate, lateral angles slightly rounded (♂) or with small, shallow emargination, lateral angles rounded (♀). Aedeagus as in Fig. 122. Length 14.0–18.0 mm (♂); 13.0–19.0 mm (♀).

Hosts. Known from poplar (*Populus* spp.) and willow (*Salix* spp.).

Distribution. Southern Manitoba, and in the eastern United States, west to Arizona.

Canadian record. Aweme, Man.

Comments. In the United States, this species is commonly found east of the Rocky Mountains. Adults are easily recognized by the blunt, subelliptic shape, by the evenly convex dorsum, and by the short elytral apices. The color is also distinctive: the punctures and foveae are light coppery, whereas the remaining body surface is dark violet brown to green. The resulting combination appears as dark mottling on a lighter, brighter background.

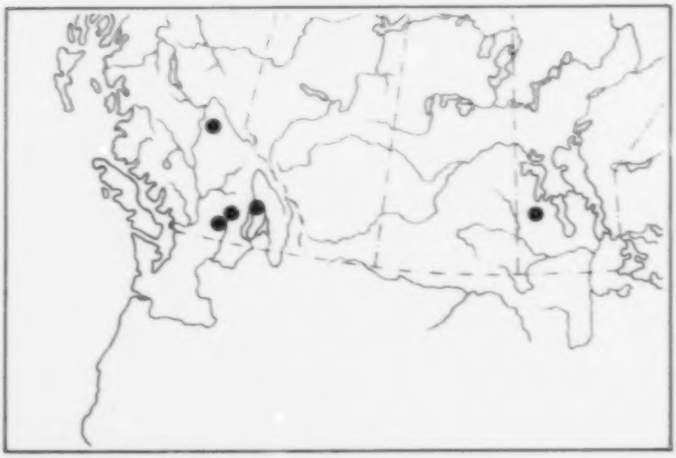
This species apparently uses both living willow and older poplar as hosts. In willow, the eggs are laid on the bark of living plants, and the larvae mine between the inner bark and the sapwood for a period of 2 years, or more, but they do not move far from the egg site. A pupal cell surrounded by frass is formed in the same area (Knull 1922).

Poecilonota montana Chamberlin

Fig. 123; Map 18

Poecilonota montanus Chamberlin, 1922:63; Chamberlin 1926:229; Evans 1957:25 (*montana*); Barr 1971:61.

Description. Very dark metallic brown gray; antennae dark coppery or bluish green; elytral apices brightly bronzed. Head deeply, coarsely punctured, with sparse, fine pubescence. Pronotum widest behind middle; sides broadly arcuate from base to apex; disc with median line narrow, fairly even, bordered by irregular punctation; lateral areas less punctate than densely punctate submarginal areas, latter frequently rugose with depressions. Elytra wider than pronotum, widest behind middle; sides sinuate; apices moderately, finely prolonged, slightly divergent, irregularly subtruncate; disc finely



Map 18. Collection localities of *Poecilonota montana*.

punctured, punctures irregularly dense, forming large, shallow foveae; costae prominent between foveae, evenly punctuate and finely striate in humeral areas; scutellar costae sparsely punctate; strial punctures small, evenly spaced. Ventral surface densely, deeply punctured; prosternal process sparsely, finely punctate without submarginal depression; apex of last visible abdominal sternite large, subtruncately emarginate (♂) or with small, shallow emargination (♀). Aedeagus as in Fig. 123. Length 11.0-16.0 mm (♂); 14.0-22.0 mm (♀).

Hosts. Known only from black cottonwood (*Populus trichocarpa*).

Distribution. Southern British Columbia to Manitoba, and in the western United States.

Comments. The distribution of *montana* is usually sufficient to distinguish its adults from those of *ferrea*, and the angular body shape and mottled gray coloration of the latter species are distinctive. The apex of the last visible abdominal sternite of male *montana* is shorter in outline than that of *ferrea*; this is less true for the female.

The distribution, body form, and coloration distinguishes adults of *montana* from those of *cyanipes* or the remaining species.

Genus *Trachykele* Marseul

Members of this genus are easily distinguished by the presence of three small, deep pits on the basal margins of the pronotum and by the lack of a visible scutellum (Figs. 125, 126). Six species occur in North America, two of which occur in Canada.

Description. Body elongate, 3.0-5.0 times longer than wide; brilliant green or black to brown with vague, blackish markings. Head flattened between eyes, weakly to strongly impressed above epistoma, median line elevated on vertex; surface densely punctured; clypeus deeply notched; eyes small, elongate-oval. Antennae serrate from fourth segment, extending almost to hind angles of pronotum, second and third segments elongate, segments 4-11 triangular (Fig. 28). Pronotum broader than long; median portion of lateral margin strongly elevated into keel-shaped carina; surface finely, densely punctured, impressed medially on anterior portion and deeply impressed laterally, with three deep pits, one just ahead of scutellum, and one each near hind angles. Elytra slightly wider than pronotum, narrowed posteriorly; surface uneven, densely, finely punctured without striae. Ventral surface densely punctured; prosternal process with sides parallel, not widened behind coxae; apex narrowed, truncate. First abdominal sternite flat medially, suture between first and second sinuate, fifth sternite subtriangular, apex roundly truncate (♀) or truncately emarginate (♂).

Comments. This genus was reviewed by Fall (1906); the Pacific Northwest species were treated by Barr (1971). Both Canadian species occur only in southern British Columbia.

Key to species of *Trachykele* in Canada

1. Brilliant emerald green; dorsal surface densely, roughly punctured; elytra sometimes with several slightly depressed, dark-colored spots (Fig. 125) . . . . **blondeli Marseul** (p. 90)
   Black to violet bronze; dorsal surface finely punctured; elytra with irregularly elevated, longitudinal costae and more numerous, depressed, smooth, dark spots (Fig. 126) . . . . ***nimbosa*** **Fall** (p. 92)

Tableau des espèces de *Trachykele* du Canada

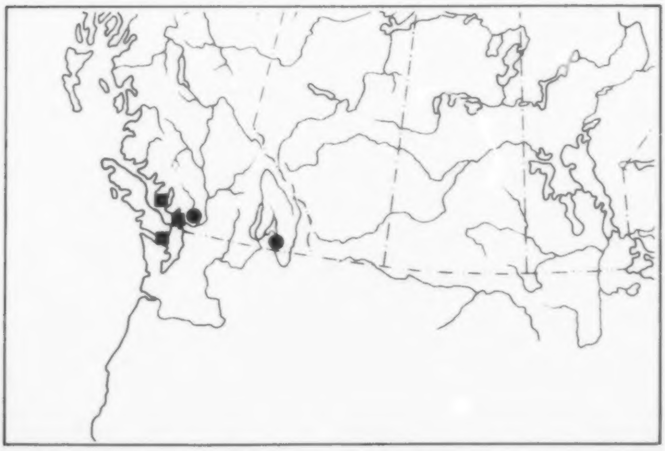
1. Vert émeraude brillant; surface dorsale densément et grossièrement ponctuée; élytres parfois avec plusieurs taches foncées légèrement enfoncées (fig. 125) . . . . ***blondeli*** **Marseul** (p. 90)
   Noir à violet bronzé; surface dorsale finement ponctuée; élytres avec des costae longitudinales, irrégulièrement soulevées, et des taches foncées plus nombreuses, lisses et enfoncées (fig. 126) . . . . ***nimbosa*** **Fall** (p. 92)

Trachykele blondeli Marseul

Figs. 28, 125; Map 19

Trachykele blondeli Marseul, 1865:150; Chamberlin 1926:241; Barr 1971:57.

Description. Brilliant emerald green on dorsal and ventral surfaces; elytra usually with several, small, impressed dark spots; ventral surface usually bearing short to moderately long, recumbent, white setae. Head convex on



Map 19. Collection localities of *Trachykele blondeli* (■) and *T. nimbosa* (●).

vertex, flattened to concave above clypeus, with narrow, elevated, median carina on upper half between eyes; surface densely, closely punctured. Pronotum with lateral margins distinctly expanded and acutely elevated midway between anterior and posterior angles; disc irregular, bearing median, concave, circular area on anterior half and laterally two deeply concave areas that extend to basal margins and occupy entire lateral-basal portion of disc; surface densely uniformly punctured, punctures deeply impressed, almost touching. Elytra with entire dorsal surface densely, deeply punctured, sometimes bearing a few small, impressed, black areas. Ventral surface colored as on dorsal surface; prosternum densely punctured, longitudinally concave; abdominal sternites finely punctured, with moderately long, white, recumbent setae; last visible abdominal sternite roundly truncate (♀) or truncately emarginate (♂). Length 14–20 mm.

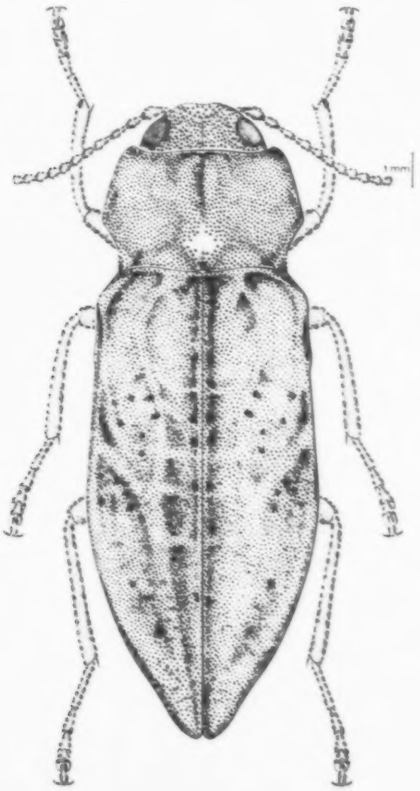


Fig. 125. *Trachykele blondeli.*

Hosts. Reared from western redcedar (*Thuja plicata*). Occurs also in California in cypress (*Cupressus* spp.) and incense cedar (*Libocedrus decurrens*).

Distribution. Coastal British Columbia to California, New Mexico, and northern Mexico.

Comments. This striking and beautiful species is easily recognized by the brilliant emerald green color of both upper and lower surfaces and by the densely, deeply punctured surfaces. Little variation was noted in the specimens available for study.

This species is commonly known as the western cedar borer. Adults emerge from infested trees in mid-May, with emergence continuing to about mid-June. Both males and females emerge together and spend their entire lives in the crowns of the trees. Mating takes place soon after emergence. Both males and females feed on the green cedar foliage.

Eggs are laid singly or in small groups deposited deep under the overlapping bark scales on the sunny upper sides of branches; thus they are completely concealed. Eggs are also laid, less commonly, on the bole in the crown. Only living trees are selected for oviposition. The eggs hatch after 12–18 days.

The newly emerged larvae bore through the bark to the cambium layer, then excavate a tunnel from the limb to the main bole. There they tunnel up or down the trunk or occasionally around the trunk, following the annual rings. Initially, the larvae work in the cambial layer but eventually enter the heartwood and excavate the major portion of their gallery there. When the larvae are full-grown, they bore out to within a couple of centimetres of the surface, then excavate a cell wherein they transform to the pupal stage. The length of time spent in the larval stage is unknown but is at least 2 years.

Transformation to the pupal stage occurs in late summer, and the pupal stage lasts about 20 days. The adults remain in the pupal cell through the winter and emerge in the spring of the following year.

The larval mines cause degrade and cull in trees cut for poles, shingles, boats, and other products requiring sound wood (Furniss and Carolin 1977). For undetermined reasons, some forest areas are especially susceptible to damage by this species; others are not. No practical control method has been developed.

Trachykele nimbosa Fall

Fig. 126; Map 19

Trachykele nimbosa Fall, 1906:164; Chamberlin 1926:242; Barr 1971:58.

Description. Black to violet bronze; elytra with numerous, impressed, smooth, black areas; ventral surface shining violet bronze. Head convex on vertex, weakly longitudinally sulcate above clypeus, a narrow, elevated, carina located on upper half between eyes; surface densely punctured, bearing moderately long, white, semirecumbent setae. Pronotum as described for *T. blondeli*. Elytra with entire dorsal surface irregular, first, third, fifth, and

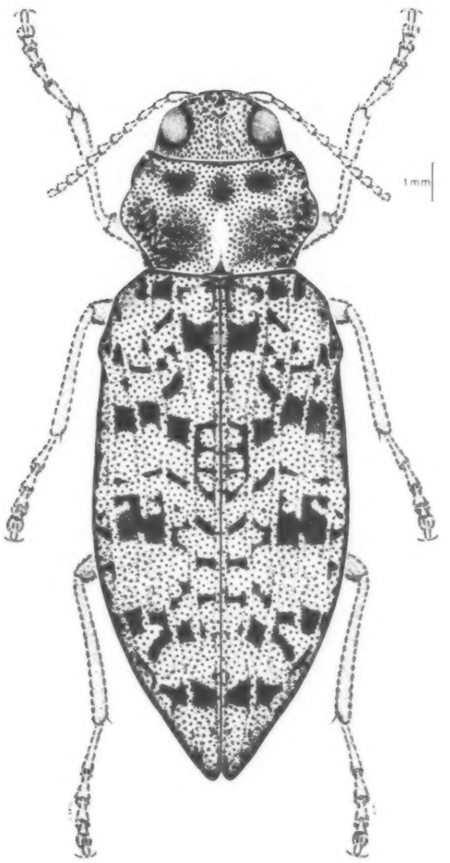


Fig. 126. *Trachykele nimbosa*.

seventh interstriae weakly costate on anterior two-thirds, surface between elevated interstriae densely punctured and rugose, except where the numerous, impressed, smooth, black areas occur, punctured areas dull, reticulate between punctures. Ventral surface shining; prosternum densely punctured, longitudinally concave; abdominal sternites more finely punctured, with moderately long, white, recumbent setae; last visible abdominal sternite roundly truncate (♀) or truncately emarginate (♂). Length 11–17 mm.

Hosts. Recorded from white fir (*Abies concolor*), grand fir (*A. grandis*), California red fir (*A. magnifica*), and mountain hemlock (*Tsuga mertensiana*).

Distribution. Southern British Columbia to California, east to Idaho.

Remarks. Adults of this species are easily recognized by the dull, dark violet to black color, with numerous, impressed, smooth, black areas.

Nothing is known of its biology, but it is probably similar to that of *blondeli* except for host preference.

Genus *Buprestis* Linnaeus

Species in this genus are among the most brilliantly colored buprestids in Canada. Color patterns are extremely variable, leading many authors in the past to describe numerous varieties and/or subspecies. Over 100 names have been applied to the *Buprestis* of North America, when actually only 23 species can be recognized.

Members of this genus are all borers in dead, partially dead, or dying trees and large shrubs. Species such as *nutalli*, *laeviventris*, and *langii* occur only in conifers, whereas *viridisuturalis* and *confluenta* occur exclusively in deciduous hosts.

Eggs are generally laid in crevices or cracks on the bark or on exposed wood. Larvae feed in the wood for at least 2 years but may feed for a considerably longer period under dry conditions. The larvae prefer dead wood and should be considered beneficial in that they aid in the breakdown of woody tissue. The larvae can be found occasionally in slightly injured trees, and their boring either kills the trees or causes serious damage to the wood.

Description. Body elongate, 2.5–4.0 times longer than wide, subcylindrical; brilliant green with violet, bluish, or purplish reflections or dark coppery brown with yellowlike or orange maculations on elytra, pronotum, and ventral surface. Head convex, densely punctured; clypeus arcuately incised; eyes widely separated; antennae serrate, reaching almost to hind angles of pronotum, first segment suboval, second segment small, globose, segments 3–11 subtriangular (Fig. 30). Pronotum evenly rounded laterally to inflated at base and sinuate at middle; disc evenly punctate or with irregular, impressed areas, evenly convex to longitudinally sulcate in median line. Scutellum small. Elytra slightly wider than pronotum, moderately narrowed posteriorly; apex not extending beyond abdomen, apices rounded to weakly notched; disc evenly striate, cribrate with rows of large punctures, or costate. Ventral surface finely punctured; prosternal process with sides parallel, not widened behind coxae, smooth to longitudinally medianly sulcate. First abdominal sternite convex to medianly sulcate; second, third, and fourth sternites about equal in length; fifth sternite subtriangular, apex rounded or truncate (♀) or truncate (♂).

Comments. This genus was revised by Helfer (1941) and the northwestern species were treated by Barr (1971).

Helfer (1941) and Nelson (1981) recognized three subgenera of *Buprestis*, *Buprestis*, *Sterosa* Casey, and *Cypriacis* Casey. These subgenera are supported by the larval studies of Burke (1918). The subgenera are not used here because they do not aid in the identification of species nor in our understanding of the generic relationships.

Key to species of *Buprestis* in Canada

(Modified from Helfer (1941) and Barr (1971))

1. Elytra with large, deep punctures forming longitudinal rows, intervals between rows closely punctured; elytra green, bluish, or purplish, with suture and side margins coppery to brilliant cupreous; Ontario .... ***salisburyensis* Herbst** (p. 100)
   Elytra with four or five costae separated by wide, densely punctured intervals, **or** elytra with small, strial punctures forming even rows, intervals between rows weakly to moderately elevated; color variable but not as above .. 2
2. Elytra with 4 or 5 costae separated by wide, densely punctured intervals . 3
   Elytra punctured in even, strial rows, punctures small, intervals weakly to moderately elevated 5
3. Elytral costae weakly elevated, weakly convex to nearly flat, summits densely punctured; eastern species .... ***striata* Fabricius** (p. 100)
   Elytral costae strongly elevated, strongly convex, nearly impunctate on summits 4
4. Elytra brilliant green or blue, with suture and lateral margins cupreous; western species .... ***aurulenta* Linnaeus** (p. 103)
   Elytra coppery brown often with greenish tinge or dark green; northern Alberta, Northwest Territories to Quebec .... ***sulcicollis* (LeConte)** (p. 104)
5. Middle of first abdominal sternite distinctly longitudinally sulcate 6
   Middle of first abdominal sternite not sulcate 21
6. Elytral interstriae about uniformly elevated 7
   Alternate elytral interstriae more strongly elevated 16
7. Elytra maculated with yellow or orange 8
   Elytra not maculated 13
8. Elytra green, with large, yellow spots 9
   Elytra brown or black, or if green, with numerous, small, yellow spots . 10
9. Elytra costae narrow and strongly convex; body often strongly elongate; western species .... ***langii* Mannerheim** (p. 105)
   Elytral costae wide and more weakly convex; body not strongly elongate; eastern species .... ***fasciata* Fabricius** (p. 107)
10. Elytra with numerous, small, isolated or more or less confluent yellow spots scattered over surface .... ***confluenta* Say** (p. 121)
    Elytra not as above 11
11. Area between eyes and antennal insertion, anterior angles of pronotum and fifth sternite usually marked with yellow or orange, color sometimes more extensive; pronotum often with a smooth median line and smooth areas toward sides; elytra sometimes with longitudinal vittae extending from base to apex 12
    Head, pronotum, and sternites not marked as above; pronotum without a smooth median line or smooth areas toward sides; elytra without longitudinal vittae; eastern .... ***fasciata* Fabricius** (dark form) (p. 107)

12. Each elytron with 2 orange or yellow longitudinal vittae, these more or less confluent and connected, sometimes not extending entire length of elytron; eastern species .... *lineata* **Fabricius** (p. 108)

Each elytron with orange or yellow irregular spots, these often connected but never forming longitudinal vittae; Manitoba to Quebec .... *maculipennis* **Gory** (p. 109)

13. Color black or brown; ventral surface of abdomen with a row of orange spots along sides and apex; elytra often with broad, shallow, tranverse impressions; eastern species .... *maculativentris* **Say** (p. 110)

Color green, blue, or reddish; western species 14

14. Apices of elytra entire, not emarginate or bidentate; suture and lateral margins often cupreous .... *intricata* **Casey** (p. 118)

Apices of elytra emarginate, bidentate, or at least with a sutural tooth; suture and lateral margins variable in color 15

15. Body short, broad; suture and lateral margins of elytra usually cupreous .. .. *adjecta* **(LeConte)** (p. 119)

Body more elongate; suture and lateral margins of elytra not cupreous .... *langii* **Mannerheim (immaculate form)** (p. 105)

16. Elytra maculated with yellow or orange markings 17

Elytra immaculate (some specimens of *lyrata* may have 1 or 2 very small spots) 18

17. Ventral surface of thorax with conspicuous and numerous orange markings; pronotum with orange markings at posterior angles; elytra with markings transverse, variable in size and usually individually broken or interrupted, second and third costae usually joined at about apical fourth; transcontinental .... *nutalli* **Kirby** (p. 114)

Ventral surface of thorax usually immaculate; pronotum without orange markings at posterior angles; elytra with spots usually large, tending to be somewhat linear, frequently coalesced longitudinally and not individually broken, second and third costae obsolete apically, not distinctly joined; southeast British Columbia .... *laeviventris* **(LeConte)** (p. 117)

18. Elytra not black or blackish bronze 19

Elytra black or blackish bronze 20

19. Front of head, anterior angles of pronotum and ventral surface usually with orange markings; suture and lateral margins of elytra never brilliant cupreous; body not oblong; pronotum not impressed medianly but usually with a smooth noncupreous median line; southern British Columbia .... *subornata* **(LeConte)** (p. 112)

Front of head, anterior angles of pronotum, and ventral surface without orange markings; suture and lateral margins of elytra usually brilliant cupreous; body oblong; pronotum often impressed medianly and often with a cupreous, smooth median line; British Columbia and Alberta ......*intricata* **Casey** (p. 118)

20. Elytral costae strongly convex; color dull black, often with slight greenish or purplish tinge; average length 20 mm; British Columbia to Nova Scotia . ... *lyrata* **Casey** (p. 113)

Elytral costae weakly convex; color more shining, dark bronze, sometimes slightly greenish or brown; average length 16 mm; Northwest Territories and Alberta to Nova Scotia .... *maculativentris* **Say** (p. 110)

21. Elytra orange or yellow **or** marked with orange or yellow 22

Elytra devoid of orange or yellow markings, often somewhat cupreous .. 26

22. Elytra with numerous, small, and isolated or more or less confluent yellow spots scattered over surface; British Columbia to Ontario .... *confluenta* **Say** (p. 121)

Elytra not marked as above 23

23. Elytra yellow to light brownish, irregular sutural stripe green, blue, or purple, apices and apical margins often tinged with orange or red; probably in southern British Columbia .... *viridisuturalis* **Nicolay & Weiss** (p. 122)

Elytra not predominantly yellow, or with the yellow confined to several spots 24

24. Elytra with 5 or 6 yellow or orange spots; pronotum sparsely, shallowly punctured; probably in southern British Columbia .... *gibbsii* **(LeConte)** (p. 123)

Elytra with 2 to 4 yellow or orange spots; if with 6 spots then pronotum closely, deeply punctured 25

25. Elytral costae narrow and strongly convex; body often strongly elongate; western species .... *langii* **Mannerheim** (p. 105)

Elytral costae wide and feebly convex; body not strongly elongate; eastern species .... *fasciata* **Fabricius** (p. 107)

26. Elytral apices emarginate or bidentate 27

Elytral apices rounded, not emarginate or bidentate; British Columbia and Alberta .... *intricata* **Casey** (p. 118)

27. Body rather elongate; elytral suture never cupreous 28

Body short, broad; elytral suture often cupreous; western species .... *adjecta* **(LeConte)** (p. 119)

28. Pronotum cupreous purple, sides slightly arcuate; pronotal disc not impressed medianly; probably in southern British Columbia ..*connexa* **Horn** (p. 120)

Pronotum greenish, sides irregularly more or less strongly, arcuately narrowed; pronotal disc often impressed medianly; western species .... *langii* **Mannerheim** (p. 105)

Tableau des espèces de *Buprestis* du Canada (modifiée de Helfer (1941) et de Barr (1971))

1. Élytres avec une ponctuation large, profonde, formant des rangées longitudinales, intervalles entre les rangées densément ponctués; élytres verts, bleuâtres ou violacés, la suture et les marges latérales cuivrées à cuivrées brillant; Ontario .... *salisburyensis* **Herbst** (p. 100)

Élytres avec 4 ou 5 costae séparées par de larges intervalles densément ponctués, ou avec la ponctuation des stries fines formant des rangées unies, les intervalles entre les rangées faiblement à modérément soulevés; couleur variable mais différente 2

2. Élytres avec 4 ou 5 costae séparées par de larges intervalles densément ponctués 3

Élytres avec des stries plates et finement ponctuées, intervalles faiblement à modérément soulevés 5

3. Costae des élytres faiblement soulevées, légèrement convexes à presque plates, leur sommet densément ponctué; espèce de l'Est ..*striata* **Fabricius** (p. 100)

Costae des élytres fortement soulevées, très convexes, leur sommet presque sans ponctuation 4

4. Élytres d'un vert ou bleu brillant avec la suture et les marges latérales cuivrées; espèce de l'Ouest .... *aurulenta* **Linnaeus** (p. 103)

Élytres d'un brun cuivré souvent avec une teinte verdâtre ou vert foncé; nord de l'Alberta, Territoires du Nord-Ouest jusqu'au Québec .... *sulcicollis* **(LeConte)** (p. 104)

5. Milieu du premier sternite abdominal avec un sillon longitudinal 6

Milieu du premier sternite abdominal sans sillon 21

6. Interstries des élytres à peu près uniformément soulevés 7

Interstries impairs des élytres plus fortement soulevés 16

7. Élytres avec des taches jaunes ou orangées 8

Élytres sans taches 13

8. Élytres verts, avec de grosses taches jaunes 9

Élytres bruns, noirs, ou verts mais avec de nombreuses petites taches jaunes 10

9. Costae des élytres étroites et très convexes; corps souvent très allongé; espèce de l'Ouest .... *langii* **Mannerheim** (p. 105)

Costae des élytres larges et moins convexes; corps non très allongé; espèce de l'Est .... *fasciata* **Fabricius** (p. 107)

10. Élytres avec plusieurs petites taches jaunes, isolées ou plus ou moins confondues .... *confluenta* **Say** (p. 121)

Élytres différents de ci-dessus 11

11. Région entre les yeux et l'insertion antennaire, les angles antérieurs du pronotum et le cinquième sternite généralement marqués de jaune ou d'orange, la couleur parfois plus répandue; pronotum souvent avec une ligne médiane lisse et des zones lisses vers les côtés; élytres parfois avec des taches longitudinales s'étendant de la base à l'apex 12

Tête, pronotum et sternites non marqués comme ci-dessus; pronotum sans ligne médiane lisse et sans zones lisses vers les côtés; élytres sans taches longitudinales; espèce de l'Est .... *fasciata* **Fabricius** (forme foncée) (p. 107)

12. Chaque élytre avec 2 taches longitudinales orangées ou jaunes, plus ou moins confondues, parfois ne s'étendant pas sur toute la longueur de l'élytre; espèce de l'Est .... *lineata* **Fabricius** (p. 108)

Chaque élytre avec des taches irrégulières orangées ou jaunes, souvent confondues mais sans former des taches longitudinales; Manitoba jusqu'au Québec .... *maculipennis* **Gory** (p. 109)

13. Couleur noire ou brune; surface ventrale de l'abdomen avec une rangée de taches orangées sur les côtés et à l'apex; élytres souvent avec de larges impressions tranverses peu profondes; espèce de l'Est .. *maculativentris* **Say** (p. 110)

Couleur verte, bleue, ou rougeâtre; espèces de l'Ouest 14

14. Apex de chaque élytre entier, non échancré ou bidenté; suture et marges latérales souvent cuivrées .... *intricata* **Casey** (p. 118)

Apex de chaque élytre échancré, bidenté, ou au moins avec une dent suturale; suture et marges latérales de coloration variable 15

15. Corps trapu; suture et marges latérales des élytres généralement cuivrées ... . *adjecta* **(LeConte)** (p. 119)

Corps plus allongé; suture et marges latérales des élytres non cuivrées .... *langii* **Mannerheim** (p. 105)

16. Élytres avec des taches jaunes ou orangées 17

Élytres sans taches (certains individus de *lyrata* peuvent avoir 1 ou 2 très petites taches) 18

17. Surface ventrale du thorax avec plusieurs taches orangées bien évidentes; pronotum avec des taches orangées aux angles postérieurs; élytres avec des taches transverses, de grandeur variable, et en général interrompues; deuxième et troisième costae généralement jointes aux environs du quart apical; transcontinental .... *nutalli* **Kirby** (p. 114)

Surface ventrale du thorax généralement sans taches; pronotum sans taches orangées aux angles postérieurs; élytres avec des taches généralement larges, plutôt linéaires, souvent fusionnées longitudinalement et ininterrompues; deuxième et troisième costae effacées à l'apex, non distinctement jointes; sud-est de la Colombie-Britannique .... ***laeviventris* (LeConte)** (p. 117)

18. Élytres ni noirs ni bronzé noirâtre 19
    Élytres noirs ou bronzé noirâtre 20

19. Front, angles antérieurs du pronotum et surface ventrale généralement avec des taches orangées; suture et marges latérales des élytres non cuivrées brillant; corps non oblong; pronotum sans impression médiane mais souvent avec une ligne médiane, lisse et non cuivrées; sud de la Colombie-Britannique .... ***subornata* LeConte** (p. 112)
    Front, angles antérieurs du pronotum et surface ventrale sans taches orangées; suture et marges latérales des élytres généralement cuivrées brillant; corps oblong; pronotum souvent avec une impression médiane et avec une ligne médiane lisse et cuivrée; Colombie-Britannique et Alberta .... ***intricata* Casey** (p. 118)

20. Costae des élytres très convexes; coloration noir mat, souvent avec une faible teinte verdâtre ou violacée; longueur moyenne 20 mm; Colombie-Britannique jusqu'à la Nouvelle-Écosse .... ***lyrata* Casey** (p. 113)
    Costae des élytres faiblement convexes; coloration plus luisante, bronze foncé, parfois un peu verdâtre ou brune; longueur moyenne 16 mm; Territoires du Nord-Ouest et Alberta jusqu'à la Nouvelle-Écosse .... ***maculativentris* Say** (p. 110)

21. Élytres orangés ou jaunes, ou avec des taches orangées ou jaunes 22
    Élytres sans taches orangées ou jaunes, souvent plutôt cuivrés 26

22. Élytres avec plusieurs petites taches jaunes, isolées ou plus ou moins confondues; Colombie-Britannique jusqu'à l'Ontario .... ***confluenta* Say** (p. 121)
    Élytres différemment tachés 23

23. Élytres jaunes à brun pâle, bande irrégulière suturale verte, bleue ou violette, l'apex et les marges apicales souvent avec une teinte orangée ou rouge; probablement dans le sud de la Colombie-Britannique .... ***viridisuturalis* Nicolay & Weiss** (p. 122)
    Élytres non principalement jaunes, ou avec du jaune restreint à plusieurs taches 24

24. Élytres avec 5 ou 6 taches jaunes ou orangées; pronotum avec une ponctuation éparse et peu profonde; probablement dans le sud de la Colombie-Britannique .... ***gibbsii* (LeConte)** (p. 123)
    Élytres avec 2 à 4 taches jaunes ou orangées; si avec 6 taches, pronotum avec une ponctuation dense et profonde 25

25. Costae des élytres étroites et très convexes; corps souvent très allongé; espèce de l'Ouest .... ***langii* Mannerheim** (p. 105)
    Costae des élytres larges et faiblement convexes; corps non fortement allongé; espèce de l'Est .... ***fasciata* Fabricius** (p. 107)

26. Apex de chaque élytre échancré ou bidenté 27
    Apex de chaque élytre arrondi; Colombie-Britannique et Alberta .... ***intricata* Casey** (p. 118)

27. Corps plutôt allongé; suture de l'élytre non cuivrée 28
    Corps trapu; suture de l'élytre souvent cuivrée; espèce de l'Ouest .... ***adjecta* (LeConte)** (p. 119)

28. Pronotum cuivré violet, les côtés un peu arqués; disque du pronotum sans impression médiane; probablement dans le sud de la Colombie-Britannique .... ***connexa* Horn** (p. 120)
    Pronotum verdâtre, les côtés plus ou moins fortement rétrécis; disque du pronotum souvent avec une impression médiane; espèce de l'Ouest .... ***langii* Mannerheim** (p. 105)

Buprestis salisburyensis Herbst

Fig. 127

Buprestis salisburyensis Herbst, 1801:174; Knull 1925:19; Chamberlin 1926:124; Helfer 1941:138; Craighead 1950:193; Wellso et al. 1976:8.
Buprestis ultramarina Say, 1839:160.
Buprestis decora Fabricius, of Casey, 1909:27.
Buprestis salisburyensis cazieri Helfer, 1946:100.

Description. Elytra green, with suture and lateral margins bright coppery, or with purple or blue stripe or with surface entirely dark coppery with suture and lateral margins dull and darker; ventral surface bright coppery to green. Head with or without frontal median line, with or without small, levigated areas; surface coarsely, closely punctured, sparsely pilose. Antennae blackish green, first two segments bronze. Pronotum widest at base; sides arcuately, evenly narrowed to apex; surface coarsely punctured, more sparsely along slightly impressed median line. Elytra slightly wider than pronotum; sides slightly sinuate at apical fourth; apex entire, with small sutural tooth; disc without striae but with longitudinal rows of large punctures; interstriae densely, coarsely punctate. Ventral surface with prosternum coarsely punctate, impressed medianly; apex of last visible abdominal sternite truncate (♂) or subtruncate (♀). Aedeagus as in Fig. 127. Length 10–15 mm.

Hosts. Recorded from pitch pine (*Pinus rigida*) and jack pine (*P. banksiana*).

Distribution. Ontario through the eastern United States to Georgia.

Canadian record. Crow Lake, Ont., jack pine.

Comments. Adults of this species are easily recognized by the large, deep, strial punctures, by the densely punctured interstriae, and by the coloration of the body as given under the description. This species is the only representative of the subgenus *Sterosa* that occurs in Canada.

Buprestis salisburyensis is one of the earliest species of the genus to appear in the spring. It has been taken in various habitats, all of which are associated with pitch pine or jack pine. Nothing is known of its life cycle or other habits.

Buprestis striata Fabricius

Fig. 128; Map 20

Buprestis striata Fabricius, 1775:217; Knull 1925:18; Chamberlin 1926:125; Helfer 1941:144; Craighead 1950:193; Wellso et al. 1976:9.
Buprestis impedita Say, 1839:160.
Buprestis canadensis Casey, 1909:124.
Buprestis obscura Casey, 1909:125.

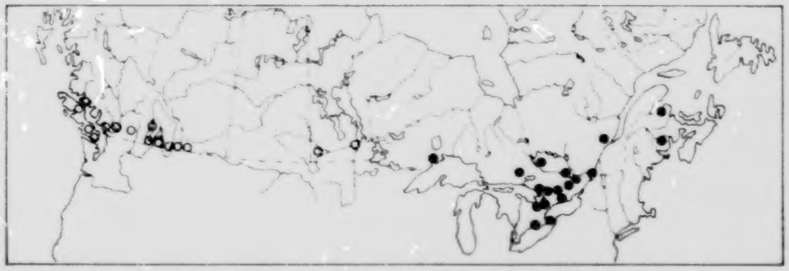
Description. Elytra uniform dull coppery brown varying to bright green or blue, with suture and lateral margins brilliant coppery; ventral surface green to bright or dark coppery. Head often with longitudinal median carina; surface densely punctate, feebly pubescent. Antennae metallic green to bronze or cupreous. Pronotum widest at base; sides sometimes parallel to middle, broadly rounded to apex or sides gradually narrowed and only slightly arcuate to apex; surface coarsely punctured, punctures separated by about their own diameters, tending to form chains, or punctures more widely separated, scattered. Elytra wider than pronotum; sides parallel or slightly divergent to apical third, then obliquely narrowed to apex; apex very weakly emarginate, with small sutural tooth; disc with fine, weakly elevated costae, these rather evenly, densely punctate on summit, punctures widely separated, first costa sometimes abbreviated to near basal third; interstriae broad, very closely, coarsely punctured. Ventral surface with prosternum coarsely, densely punctate; abdominal sternites finely punctured; apex of last visible abdominal sternite rounded in both sexes, female more broadly rounded. Aedeagus as in Fig. 128. Length 13-20 mm.

Hosts. Recorded from longleaf pine (*P. palustris*), eastern white pine (*P. strobus*), pitch pine (*P. rigida*), Virginia pine (*P. virginiana*); eastern hemlock (*Tsuga canadensis*), spruce (*Picea* spp.), and larch (*Larix* spp.).

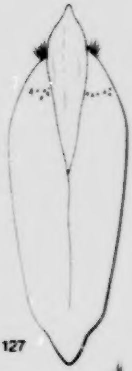
Distribution. Eastern Canada through the eastern United States, south to Florida, west to Missouri.

Comments. This species closely resembles *aurulenta* and *sulcicollis*. From *aurulenta*, adults of *striata* can be distinguished by the flatter, more densely punctured elytral costae, which in *aurulenta* are strongly convex and almost impunctate, by the often dark coppery color (adults of *aurulenta* are always light-colored), by the rarely sulcate pronotal disc, which in *aurulenta* is usually sulcate, and by the eastern distribution. Adults of *striata* differ from those of *sulcicollis* in that the latter have the elytral costae more strongly convex, the pronotum usually sulcate medianly, the color above never green or blue with coppery sutural and lateral margins, and the shape more broadened and shorter.

Specimens of *striata* have been taken from many coniferous habitats from mid-March to early May. Oviposition occurs on denuded trunks of dead and dying pines. Adults remain in the wood from late October to early spring.



Map 20. Collection localities of *Buprestis striata* (•) and *B. aurulenta* (○).



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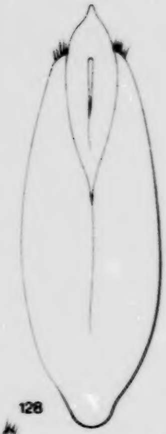

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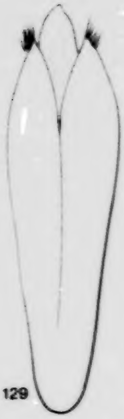

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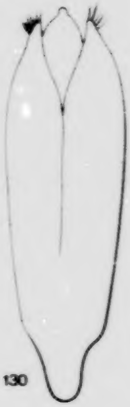

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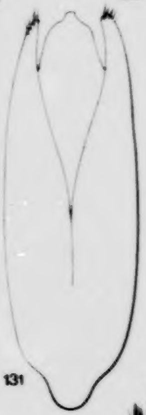

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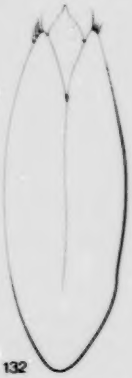

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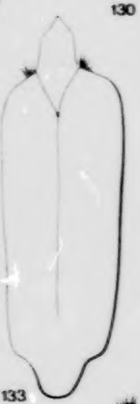

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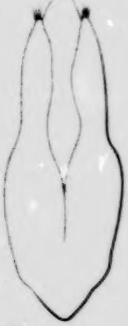

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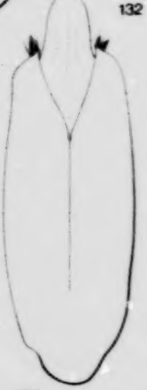

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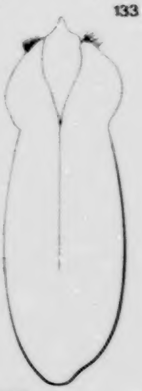

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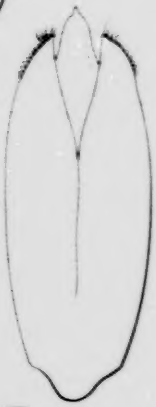

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Buprestis aurulenta Linnaeus

Frontispiece, Fig. 130; Map 20

Buprestis aurulenta Linnaeus, 1767:661; Chamberlin 1926:104; Helfer 1941:140; Barr 1971:61; Furniss and Carolin 1977:257.

Ancylochira radians LeConte, 1854:17.
Ancylochira lauta LeConte, 1854:17.
Stigmodera chrysochlora Philippi, 1864:314.
Buprestis villosa LeConte, 1873:331.
Buprestis fabulosa Casey, 1909:120.
Buprestis aemula Casey, 1909:121
Buprestis tacomae Casey, 1909:121.
Buprestis nupta Casey, 1909:122.
Buprestis venusta Casey, 1909:122.
Buprestis affinis Casey, 1909:123.
Buprestis adulans Casey, 1909:123.

Description. Elytra green to blue or, more rarely, slightly purplish, suture and lateral margins bright coppery; pronotum and head entirely bright coppery to green, blue or, rarely, purplish; ventral surface green, blue, sometimes purplish. Head with distinct median carina; surface deeply, confluently punctured, rather densely pilose in some specimens. Antennae metallic green to bronze or coppery. Pronotum variable in width; sides evenly narrowed from base to apex or slightly to broadly arcuate from base to apex or parallel from base to apical third, then strongly arcuate to apex; disc longitudinally sulcate medially, with smooth, median line, or with no trace of either; surface coarsely, densely punctured, sometimes finely pilose. Elytra slightly wider than pronotum; sides diverging slightly to apical third and broadly rounded, then slightly arcuate to apex; apex obliquely or squarely cut, entire, often with sutural tooth; disc with 5 costae, these strongly elevated and nearly impunctate on summit; interstriae broad, coarsely, closely punctured, punctures more or less confluent and somewhat transversely rugulose. Ventral surface with prosternum coarsely and densely punctate; abdominal sternites finely punctured; apex of last visible abdominal sternite subtruncate in both sexes. Aedeagus as in Fig. 130. Length 13–22 mm.

Hosts. Recorded from grand fir (*Abies grandis*), ponderosa pine (*Pinus ponderosa*), limber pine (*P. flexilis*), bishop pine (*P. muricata*), Jeffrey pine (*P. jeffreyi*), sugar pine (*P. lambertiana*), lodgepole pine (*P. contorta*), Monterey pine (*P. radiata*), Douglas-fir (*Pseudotsuga menziesii*), and western redcedar (*Thuja plicata*).

Figs. 127–137. Aedeagi of *Buprestis* species (redrawn from Helfer 1941). 127, *B. salisburyensis*; 128, *B. striata*; 129, *B. langii*; 130, *B. aurulenta*; 131, *B. sulcicollis*; 132, *B. fasciata*; 133, *B. lineata*; 134, *B. maculipennis*; 135, *B. maculativentris*; 136, *B. subornata*; 137, *B. lyrata*.

Distribution. Southern British Columbia to Manitoba, and the western United States.

Comments. This is one of the most strikingly beautiful buprestids in western North America. The brilliant green of the pronotum and elytra, with the contrasting coppery reflections along the lateral margins of the elytra and along the suture are unmistakable.

Adults of *aurulenta* are similar to those of *sulcicollis* and *striata*, which are eastern in distribution. In addition, adults of *aurulenta* differ from *sulcicollis* by the brighter greenish color, *sulcicollis* being dark coppery brown and unicolorus. The adults of *striata* are distinguished from those of *aurulenta* by the more strongly convex, impunctate, elytral costae.

This species occurs from sea level to about 2400 m in elevation. Larval mines are found in dead portions of living trees as well as in stumps, exposed roots, and down wood. Lightning-struck trees are especially subject to attack. Furniss and Carolin (1977) claim that *aurulenta* is the most destructive western species in the genus. The larvae mine in and around fire scars and mechanical injuries, causing additional defect, especially in ponderosa pine and Douglas-fir. They are of principal concern in buildings, especially in the Pacific Northwest. The damage consists of mined boards and timbers and of exit holes bored through finished surfaces.

Eggs are laid in flat masses wedged in cracks in the wood. The newly hatched larvae have numerous long hairs and the body ends in two sharp projections; older larvae lack the hairs and the sharp spinelike projections. Adults feed on needles of Douglas-fir and other conifers before egg laying. The life cycle in natural conditions requires 2–4 years. In buildings, the egg-to-adult development may be prolonged to 30 or 40, or even 50 years, or more.

Buprestis sulcicollis (LeConte)

Fig. 131

Ancylochira sulcicollis LeConte, 1860:209.

Buprestis sulcicollis: Knull 1925:18; Chamberlin 1926:127; Helfer 1941:142; Wellso et al. 1976:8.

Buprestis lateralis Casey, 1909:119.

Description. Surface of pronotum and elytra dull, dark coppery brown to black or green, elytral costae more shining, pronotum sometimes purplish, ventral surface purplish coppery to greenish. Head often with longitudinal, median line; surface finely, densely punctate, with long pubescence. Antennae black, metallic. Pronotum widest at base; sides gradually narrowed to apical third, then broadly rounded to apex; surface medianly, deeply sulcate, punctures dense at sides and in median depression. Elytra wider than pronotum; sides usually parallel but sometimes diverging to apical third, broadly rounded at apical third and obliquely narrowed to apex; apex narrow, entire, sutural angles right; disc with 4 to 5 costae, these strongly convex and finely punctured on summit; interstriae broad, coarsely, randomly punctured and rugose. Ventral surface with prosternum coarsely punctate; abdominal sternites finely and densely punctured; apex of last visible abdominal sternite broadly rounded in both sexes. Aedeagus as in Fig. 131. Length 11–15.5 mm.

Hosts. Recorded from pitch pine (*Pinus rigida*) and eastern white pine (*P. strobus*).

Distribution. Northwest Territories to Quebec and in the northeastern United States, south to Pennsylvania and Michigan.

Comments. Adults of *sulcicollis* may be distinguished from those of *striata*, its closest ally in the east, by the more strongly convex elytra costae, by the finely punctured elytral costae, and by the darker coloration. *Buprestis aurulenta* is also closely related, but it is easily distinguished by the coloration and distribution.

This species is relatively uncommon and occurs principally from the Great Lakes to the Atlantic seaboard.

Nothing is known of its habits.

Buprestis langii Mannerheim

Fig. 129; Map 21

Buprestis langii **Mannerheim, 1843:237; Chamberlin 1926:152; Helfer 1941:152; Barr 1971:62; Furniss and Carolin 1977:259.**

Ancylochira ornata **Walker, 1866:324.**

Buprestis bistrinotata **Casey, 1909:108.**

Buprestis angusta **Casey, 1909:108.**

Buprestis callida **Casey, 1909:108.**

Buprestis fastidiosa **Casey, 1909:109.**

Buprestis fastidiosa mediocris **Casey, 1909:109.**

Buprestis crenata **Casey, 1909:110.**

Buprestis crenata seditiosa **Casey, 1909:110.**

Buprestis leviceps **Casey, 1909:110.**

Buprestis depressa **Casey, 1909:111.**

Buprestis viridimicans **Casey, 1909:111.**

Buprestis langi incolumis **Casey, 1909:112.**

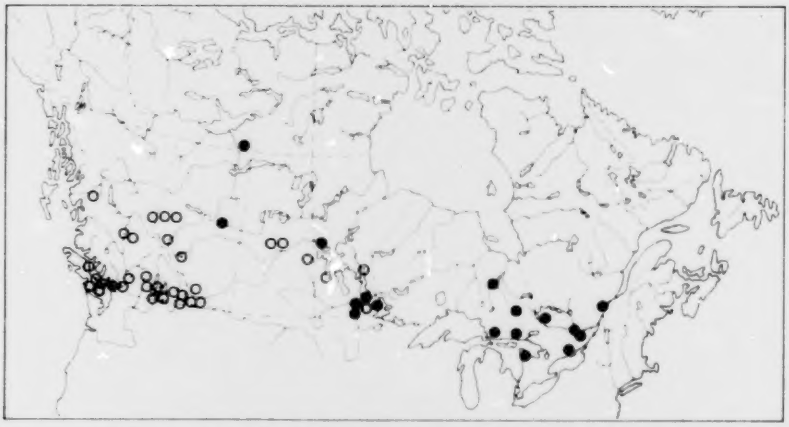
Buprestis langi oregona **Casey, 1909:112.**

Buprestis langi obliqua **Casey, 1909:113.**

Buprestis patruelis **Casey, 1909:113.**

Buprestis graminea **Casey, 1909:113.**

Description. Upper surface green to blue or dark coppery purple, sometimes elytra green with suture blue; elytra immaculate or with 2, 4, or 6 yellow to tan spots; ventral surface green to brilliant light reddish coppery. Head often with weak, longitudinal, median sulcus at vertex; surface coarsely, densely punctate, sparsely to not pilose. Antennae dark green to bronzy. Pronotum widest at base or at middle; sides slightly arcuate, narrowed from base



Map 21. Collection localities of *Buprestis sulcicollis* (•) and *B. langii* (○).

to apex or more broadly arcuate, acutely narrowed to apex, sometimes slightly sinuate before middle; disc sometimes with a vague, longitudinal, median impression, often with a broad, deep impression at middle toward sides, or sometimes a pair of impressions slightly before middle and about halfway from the median impression to the lateral margins; surface coarsely punctate, more so toward sides, punctures separated by a distance about equal to their own diameters but tending to coalesce into loose chains or small groups. Elytra wider than pronotum; sides parallel to weakly sinuate to behind middle, then broadly rounded and distinctly narrowed to apex; apex emarginate or bidentate or with sutural tooth; discal striae coarsely punctate to rugose, about as wide as interstrial costae; costae uniformly convex, uniformly elevated, feebly rugulose. Ventral surface with first sternite longitudinally sulcate; sternites densely punctured; apex of last visible abdominal sternite broadly rounded to sinuate at sides, truncate to bidentate. Aedeagus as in Fig. 129. Length 15–21 mm.

Hosts. Larvae occur in wood of Douglas-fir (*Pseudotsuga menziesii*); adults found on foliage of willow (*Salix* spp.) and alder (*Alnus* spp.).

Distribution. Western Canada and western United States, south to California and New Mexico.

Comments. Adults of this species vary greatly in coloration, maculation, and form. The two anterior elytral spots of the male often coalesce into a dumbbell-shaped vitta; the female is often immaculate or may have two, four, or six spots. The spots on the male are definitely larger than those on the female. The sides of the elytra may sometimes be coppery and the elytral color varies from reddish to golden green or brassy, through green, to blue or purple.

This species is evidently closely related to *fasciata* and the adults of *langii* may be distinguished by the somewhat more elongate form, by the narrower and more strongly elevated elytral costae, by the wider striae, by the frequently immaculate females, and by the western distribution.

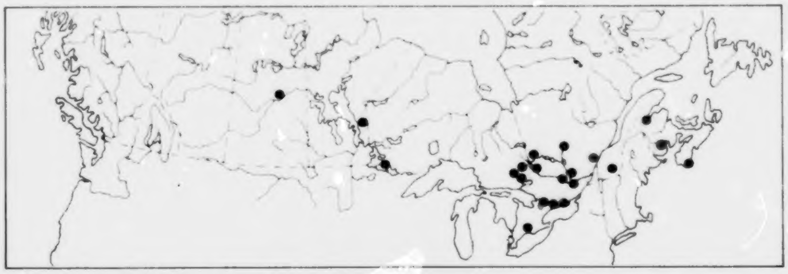
Nothing is known of its habits other than that mentioned under hosts.

Buprestis fasciata Fabricius

Fig. 132; Map 22

Buprestis fasciata Fabricius, 1787:177; Knull 1925:22; Chamberlin 1926:109; Helfer 1941:155; Craighead 1950:193.
Buprestis sexmaculata Hausmann, 1799:30.
Buprestis lherminieri Chevrolat, 1838:68.
Ancylochira sexplagiata LeConte, 1860:205.
Buprestis fulgens Casey, 1909:107.
Buprestis fasciata fortunata Casey, 1909:107.
Buprestis saturata Casey, 1909:114.

Description. Elytra green, more or less brassy blue, or blackish in female, female always with a transverse band behind middle, almost always with small, subapical spot, often with small spot before the transverse band, spots yellow, male with band just behind middle plus subapical and basal spots. Head often with shallow, longitudinal sulcus on vertex; surface coarsely punctate. Antennae black or bronzed to green. Pronotum widest at base or at middle; sides parallel to middle, rounded at apex to broadly arcuate and narrowed to apex; disc frequently with faint, longitudinal impression; surface deeply, rather sparsely punctured, punctures tending to coalesce into short chains or small groups. Elytra wider than pronotum; sides weakly arcuate to parallel from base to behind middle, then rounded and narrowed to apex; apex bidentate, sometimes slightly attenuate; discal striae often feebly rugulose, narrower than interstrial costae; costae not strongly convex, sparsely



Map 22. Collection localities of *Buprestis fasciata*.

punctate, often weakly rugulose. Ventral surface with first abdominal sternite longitudinally impressed; abdominal sternites shallowly and finely punctured; apex of last visible abdominal sternite truncate. Aedeagus as in Fig. 132. Length 11-18 mm.

Hosts. Not definitely established. Helfer (1941) gives "Dead pine?, maple?, and poplar?" and Nelson et al. (1981) gives "on oak."

Distribution. Eastern Canada through the eastern United States, south to Florida, west to Michigan, Indiana, and Mississippi.

Comments. This species is related to *langii*, but the adults of *fasciata* may be distinguished by the color pattern, by the wider and more weakly convex elytral costae, by the less elongate body form, and by the eastern distribution.

Nothing is known of the habits of this species.

Buprestis lineata Fabricius

Fig. 133

Buprestis lineata Fabricius, 1775:217; Knull 1925:20; Chamberlin 1926:114; Helfer 1941:157.

Buprestis lineata var. *davisi* Nicolay and Weiss, 1918:95; Helfer 1941:157.

Description. Black or brown above, often with a brassy or coppery shine; frons and underside of head, lateral margin, and front angle of pronotum, anterior portion of prosternum, and last visible ventral segment maculated with reddish orange or yellow spots; elytra with 2 orange or reddish to yellow vittae, one on side extending around humerus and extending almost to apex, the other beginning near middle of base extending to apical third or fourth. Head with median sulcus, this sometimes obsolete; frons often with two weakly swollen spots, these sometimes joined; surface shallowly, densely punctate. Antennae cupreous to bronzy green. Pronotum broadest at base; sides only slightly arcuate to feebly sinuate; disc occasionally with a smooth, unimpressed median line, sides densely punctured, punctures coarse, separated by one to three times their own diameters. Elytra widest at base, wider than pronotum; sides narrowing evenly to apical third, then more strongly converging to apices, or evenly narrowed from base to apices; apices bisinuate, sutural and external angles produced; discal striae distinct, not broad; discal interstriae slightly convex, uniformly elevated, coarsely, shallowly, and sparsely punctate. Ventral surface with first abdominal sternite longitudinally impressed; abdominal sternites coarsely, shallowly punctate; apex of last abdominal sternite truncate (♂) or rounded (♀). Aedeagus as in Fig. 133. Length 12-17 mm.

Hosts. Recorded from longleaf pine (***Pinus palustris***), pitch pine (***P. rigida***), eastern white pine (***P. strobus***), loblolly pine (***P. taeda***), and Virginia pine (***P. virginiana***).

Distribution. Eastern Canada and eastern United States, south to Florida, west to Mississippi, Indiana, and Arkansas.

Comments. Adults of this species are easily distinguished by the longitudinal elytral vittae. *B. maculipennis* is apparently the most closely related species and has been considered a variety by various workers at different times. Adults of *maculipennis* have irregular yellowish to orange spots or bands, more or less connected but never forming vittae as in *lineata*.

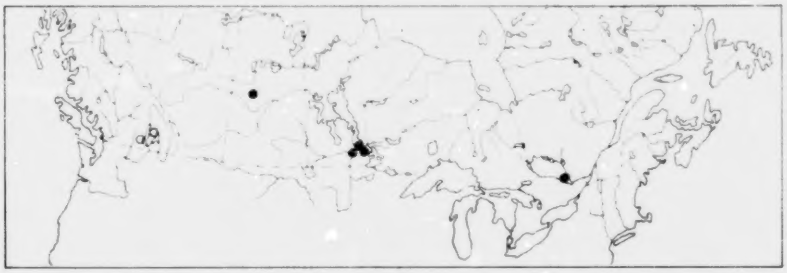
This species apparently attacks pines in the 1st year after death but also constructs galleries in injured or dying trees. Pupation occurs from April to June, adults fly from April to August (Helfer 1941).

Buprestis maculipennis Gory

Fig. 134; Map 23

Buprestis maculipennis Gory, 1841:119; Knull 1925:20; Chamberlin 1926:116; Helfer 1941:159.
Buprestis inconstans Melsheimer, 1845:146.
Buprestis maculipennis deficiens Casey, 1909:91.
Buprestis maculipennis fusiformis Casey, 1909:91.
Buprestis inconstans scripta Casey, 1909:91.
Buprestis reducta Casey, 1909:92.
Buprestis leporina Casey, 1909:92.

Description. Dark brown to black above, with more or less distinct, brassy shine; elytra with irregular yellowish spots, often connected longitudinally but not forming two distinct elytral vittae; frons and underside of head, anterior angles of elytra, prosternum, mandibles, and last visible abdominal segment all variously maculated with red or orange spots. Head often with median line, surface rather coarsely, densely punctate. Antennae black, more or less bronzy. Pronotum widest at base; sides slightly arcuately or sinuately narrowed, sometimes slightly inflated at base; disc with or



Map 23. Collection localities of *Buprestis maculipennis* (●) and *B. subornata* (○).

without faint, longitudinal, median line; surface coarsely, unevenly punctured. Elytra wider than pronotum, widest at base or at apical third; sides diverging or converging slightly from base to apical third, then broadly rounded, then narrowed to apices; apices broadly rounded to truncate, with sutural and external angles produced; discal striae distinct, not broad; discal interstriae about uniformly elevated and not strongly convex, coarsely punctate, more so toward humeri. Ventral surface with first abdominal sternite longitudinally impressed; abdominal sternites closely, coarsely punctured; apex of last visible abdominal sternite truncate (♂) or rounded (♀). Aedeagus as in Fig. 134. Length 9.2–14.5 mm.

Hosts. Recorded from jack pine (*Pinus banksiana*), and eastern white pine (*P. strobus*); probably occurs in other species of pines. Also recorded from eastern hemlock (*Tsuga canadensis*), and bald cypress (*Taxodium distichum*) (Helfer 1941).

Distribution. Known from Saskatchewan to Quebec but probably occurs more extensively; also occurs throughout the eastern United States, south to Florida and Texas.

Comments. This species is related to *lineata* but the adults of *maculipennis* may be distinguished by the maculation of the elytra, which does not form longitudinal vittae, and by the smaller body size. From similarly maculated forms of other species, *maculipennis* adults may be distinguished by the slightly convex and uniformly elevated interstriae, by the small size, and by the lack of a regular pattern of smooth spaces on the pronotum.

This species varies considerably in the extent of elytral maculation from being immaculate to having maculations covering all the elytra except the humeri. The elytral shape also varies, the apices being subattenuate in some specimens, not at all in others. The pronotum varies in shape and in the maculation of the ventral surface.

Knull (1922) reports that this species usually breeds in dead limbs and branches.

Buprestis maculativentris Say

Figs. 30, 135; Map 24

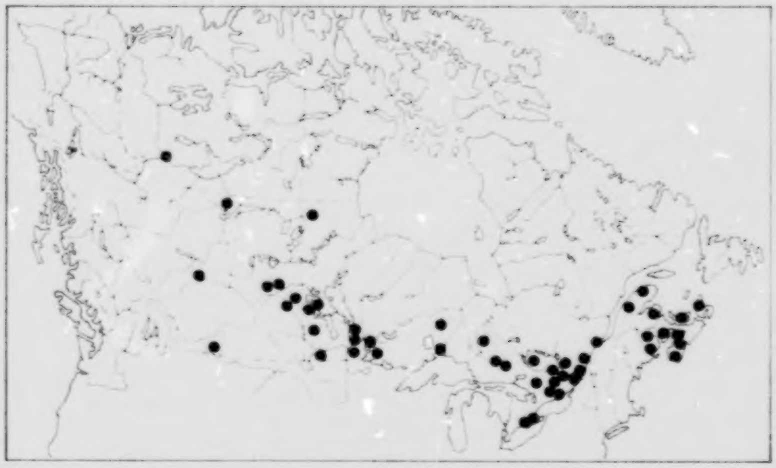
Buprestis maculativentris Say, 1824:272; Knull 1925:20; Chamberlin 1926:116; Helfer 1941:161.

Buprestis rusticorum Kirby, 1837:151.

Buprestis paganorum Kirby, 1837:152.

Buprestis sexnotata Gory and Laporte, 1841:129.

Description. Dark bronzy to brown or greenish above; frons and underside of head and anterior angles of pronotum usually maculated with orange spots; ventral surface bronze to greenish, middle coxae sometimes maculated, last four abdominal segments externally maculated with orange spots; elytra immaculate, often with transverse, broad depressions. Head often with line



Map 24. Collection localities of *Buprestis maculativentris*.

on frons, this may extend to vertex; surface densely, coarsely punctate. Antennae bronzed to greenish. Pronotum broadest at base; sides moderately arcuate to sinuate at or slightly behind middle; disc often with an unimpressed median line; surface coarsely, densely but unevenly punctate, often with scattered, smooth spaces. Elytra wider than pronotum, widest at base or apical third; sides diverging or converging to apical third, then more or less strongly narrowed to apices; apices rounded or truncate or oblique, microspiculose; surface with broad, transverse, shallow depressions; discal striae distinct, narrow; discal interstriae impunctate to sparsely punctured, shining to rather dull. Ventral surface with first abdominal sternite longitudinally sulcate; abdominal sternites densely, evenly punctate, punctures coarse but not deep; apex of last visible abdominal sternite truncate (♂) or broadly rounded (♀). Aedeagus as in Fig. 135. Length 13–20 mm.

Hosts. Recorded from Fraser fir (*Abies fraseri*), red pine (*Pinus resinosa*), shortleaf pine (*P. echinata*), eastern white pine (*P. strobus*), and white spruce (*Picea glauca*).

Distribution. Northwest Territories and Alberta to Nova Scotia through the northeastern United States.

Comments. This is a common eastern species that occurs uncommonly in Western Canada. It is closely related to two western forms, *subornata* and *lyrata*. Adults of *subornata* are usually greener, with the alternate elytral costae more strongly convex and the abdominal maculations more transverse. Adults of *lyrata* are usually duller, blacker, larger, more oblong, with the alternate elytral costae more strongly convex, and the smooth pattern on the pronotum more distinct. The orange markings on the head of *maculativentris* are much less extensive than those on *lyrata* also.

The adults vary considerably in color as given under description. The usual color is shiny bronzy but may be greenish brown. The elytral sculpturing, the form of the pronotum, and the shape of the elytra also vary greatly. The markings on the ventral surface are usually constant in shape, form, and color.

Nothing is known of the biology.

Buprestis subornata (LeConte)

Fig. 136; Map 23

Ancylochira subornata LeConte, 1860:208.

Buprestis subornata: Chamberlin 1926:118; Helfer 1941:163; Barr 1971:64.

Buprestis rubronotans Casey, 1909:97.

Buprestis adonea Casey, 1909:97.

Buprestis histrio Casey, 1909:98.

Buprestis subornata punctiventris Casey, 1909:99.

Buprestis violescens Casey, 1909:99.

Description. Immaculate green to blue, violet, coppery green or dark purplish, rarely black; side of abdomen usually maculated with a double row of more or less transversely connected orange spots; frons and anterior angles of pronotum often marked with orange; underside of head often marked with red or yellow. Head usually with median line; surface coarsely, densely punctate on frons, less closely on vertex. Antennae black, with greenish tinge. Pronotum widest at base, usually trapezoidal, but sometimes with sides arcuate, sinuate, or slightly inflated; disc with smooth, unimpressed median line and usually with levigated areas about one-fourth from sides at base, and about one-third from sides before middle; surface coarsely, unevenly punctate, punctures tending to form small, separated groups. Elytra wider than pronotum, widest at base; sides slightly narrowed to apical third, then broadly rounded and obliquely narrowed or gradually narrowed from base to apex; apices slightly attenuate, rounded to suture or truncate, often microspiculose; discal striae distinct, narrow; surface with broad, shallow, transverse depressions, costate, costae not strongly convex, rugose to sparsely and finely punctured; alternating costae less strongly convex to flat, vaguely rugose and finely, closely punctate. Ventral surface with first abdominal sternite deeply, longitudinally sulcate; abdominal sternites coarsely, closely and uniformly punctate; apex of last visible abdominal sternite truncate in both sexes. Aedeagus as in Fig. 136. Length 15–21 mm.

Hosts. Known from ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*).

Distribution. Southern British Columbia through the western United States, east to Kansas.

Comments. This species is related to the eastern *maculativentris* and the western *lyrata*. From *lyrata*, adults of *subornata* may be distinguished by the smaller average size, by the less strongly convex elytral costae, and by the more greenish to bluish tint in the coloration.

This species varies considerably in elytral color, in the shape of the abdominal transverse maculations, in the form of the pronotum, and in the shape and sculpturing of the elytra.

Buprestis lyrata Casey

Fig. 137; Map 25

Buprestis rusticorum of authors, *nec* Kirby, 1837:151; Chamberlin 1926:119; Helfer 1941:165; Barr 1971:64.

Buprestis lecontei Saunders, 1871:40; Barr 1972:343 (preoccupied).

Buprestis acomana Casey, 1909:101.

Buprestis morosa Casey, 1909:101.

Buprestis fusca Casey, 1909:101.

Buprestis fusca sublivida Casey, 1909:102.

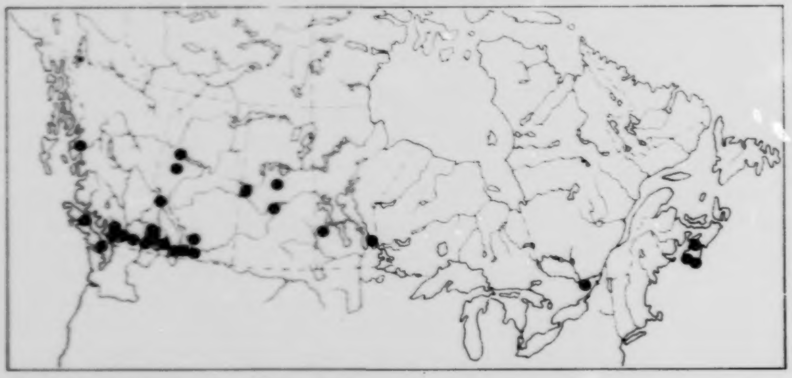
Buprestis caliginosa Casey, 1909:102.

Buprestis nigricans Casey, 1909:102.

Buprestis lyrata Casey, 1909:103.

Buprestis adducta Casey, 1909:103.

Description. Black above, varying to obscurely greenish or purplish, sometimes slightly blue; remainder of color as in *subornata* except maculations on ventral surface sometimes transversely confluent. Head and antennae as in *subornata*. Pronotum and elytra as in *subornata*. Aedeagus as in Fig. 137. Length 15–23 mm.



Map 25. Collection localities of *Buprestis lyrata*.

Hosts. Recorded only from grand fir (*Abies grandis*), ponderosa pine (*Pinus ponderosa*), and Douglas-fir (*Pseudotsuga menziesii*); probably in pine species in the eastern portion of its range.

Distribution. Southern British Columbia to Ontario and Nova Scotia through the western United States, east to Kansas.

Comments. As indicated before, this species is closely related to *subornata* or *maculativentris*. Adults of *lyrata* are generally blacker, less shining, larger and more oblong, and the elytra usually show a more deeply furrowed appearance. This species is evidently more common in the west.

Barr (1972) states that this is the species usually known in the literature as *rusticorum*. The type of *rusticorum* is conspecific with *maculativentris*. The replacement name for the western species was determined to be *lecontei* Saunders, but *lecontei* is preoccupied; *lyrata* is the name currently in use by specialists (Nelson 1983 pers. comm.).

Nothing is known of the biology or life history of this species.

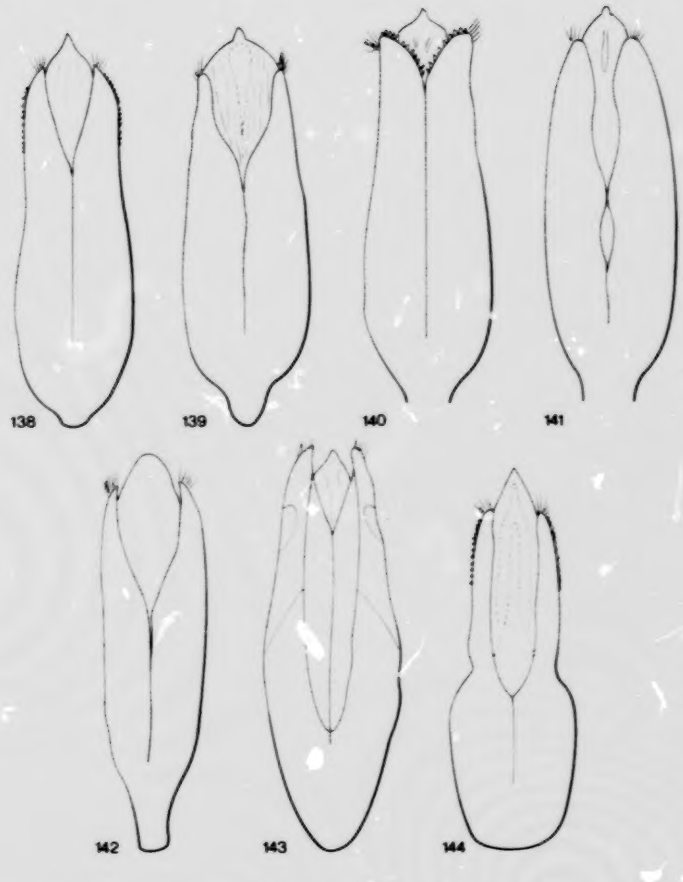
Buprestis nutalli Kirby

Figs. 138, 145; Map 26

Buprestis nutalli Kirby 1837:152; Chamberlin 1926:120; Helfer 1941:167; Barr 1971:63.

Buprestis consularis Gory, 1841:120.
Ancylochira alternans LeConte, 1860:207.
Buprestis alternans conicicauda Casey, 1909:93.
Buprestis diruptans Casey, 1909:94.
Buprestis contorta Casey, 1909:94.
Buprestis gravidula Casey, 1909:95.
Buprestis gravidula torva Casey, 1909:95.
Buprestis gravidula boulderensis Casey, 1909:96.
Buprestis flavopicta Casey, 1909:96.

Description. Elytra black, often slightly purplish, rarely immaculate, usually with 3 nearly transverse orange to yellow bands, which are usually broader at suture, all may be broken by black striae or interstriae, fourth basal band or remnants may also be present; frons usually maculated with orange or yellow; pronotum with side margins and anterior angles often orange or yellow; ventral surface except tibiae and tarsi often maculated with yellow or orange. Head with median carina on frons reaching to vertex, often shallowly depressed on each side of line, depressions very closely punctate; surface coarsely, closely punctured, punctures often confluent, irregular in shape. Antennae dark bronze. Pronotum widest at base or at middle; sides arcuate, sometimes with base strongly swollen; disc often with distinct, smooth, median line, this often obscured by punctures, often with more or less strongly tumescent area at lateral fourth, and another between midline at lateral fourth, these extremely variable in extent and shape; surface coarsely punctate, punctures separated by a distance equal to less than their diameters.



Figs. 138–144. Aedeagi of *Buprestis* spp. (redrawn from Helfer 1941). 138, *B. nutalli*; 139, *B. intricata*; 140, *B. adjecta*; 141, *B. connexa*; 142, *B. confluenta*; 143, *B. viridisuturalis*; 144, *B. gibbsii*.

Elytra wider than pronotum, widest at base or at middle; sides sometimes sinuate, more often almost straight and parallel or slightly convergent to behind middle, then narrowed to apices; apices slightly attenuate, multidentate to bisinuate or broadly rounded; striae narrow, shallowly punctured; first, third, fifth, seventh, and ninth interstriae strongly elevated, convex, shining, sparsely punctured, remaining interstriae flat or weakly convex, densely, finely punctate, often with sparse, transverse rugae. Ventral surface with prosternum coarsely punctate except process, which is impunctate

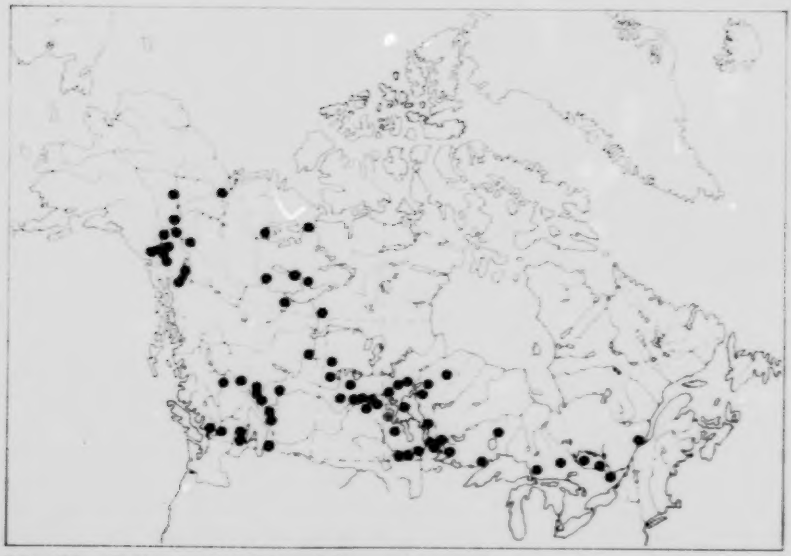
from middle to apex; first abdominal sternite longitudinally sulcate; abdominal sternites coarsely punctate; apex of last visible abdominal sternite truncate in both sexes. Aedeagus as in Fig. 138. Length 12.5-21 mm.

Hosts. Recorded from ponderosa pine (*Pinus ponderosa*), eastern white pine (*P. strobus*), balsam fir (*Abies balsamea*), and Douglas-fir (*Pseudotsuga menziesii*); probably occurs in other conifers.

Distribution. Transcontinental from Alaska to at least Quebec, south through the western United States to Arizona and New Mexico.

Comments. This species is closely related to *lyrata*, differing in most instances by the maculated elytra, although rare occurrences of immaculate *nutalli* have been recorded. Adults differ from those of *laeviventris* by the conspicuous orange markings on the ventral surface of the thorax, by the more broken elytral maculations, and by the distinct orange or yellow markings on the posterior angles of the pronotum.

Adults of *nutalli* vary considerably in size, shape, maculations, and sculpturing. Some specimens have the sides of the pronotum strongly inflated at the base and sinuate at the middle. The fine, longitudinal, smooth areas on the pronotum are about equally spaced and in some specimens are only



Map 26. Collection localities of *Buprestis nutalli*.

weakly broken. The elytral maculation is variable in shape and size. The ventral maculation is sometimes present in large quantities on all parts except the tibiae and tarsi, but in many specimens the abdomen may be almost immaculate.

Specimens are often taken by beating vegetation or while they are resting on logs or trees. Details of the life cycle are not known.

Buprestis laeviventris (LeConte)

Ancylochira laeviventris LeConte, 1857:43.

Buprestis laeviventris: Chamberlin 1926:113; Helfer 1941:170; Barr 1971:64, 65.

Buprestis laeviventris pugetana Casey, 1909:94.

Description. Black above, rarely immaculate, usually with 4 more or less transverse yellow bands that are more or less longitudinally connected, apical spot always isolated; front angles and front margin of pronotum and frons usually maculated with orange; ventral surface coppery to greenish; tip of abdomen apparently always maculated with orange, occasionally there may be double row of orange spots on each side of abdomen; underside of head maculated with yellow or red. Head often with a median line or interruption of frontal maculation; surface more finely punctate. Antennae coppery to greenish. Pronotum widest at base; sides often sinuate at about middle, sometimes evenly, arcuately narrowed from base to apex; disc with smooth, slightly elevated, median line and with levigated spaces about one-fourth from sides at base, and about one-third from sides at apical third; surface coarsely, evenly punctured. Elytra wider than pronotum; sides tapering gradually from base to apical third, then more strongly narrowed to apices, sometimes faintly sinuate between base and apical third; apices often slightly attenuate, truncate to bidentate or truncate with no dentation; discal striae coarsely but not deeply punctate; discal interstriae alternately more strongly convex, two more convex ones proceeding from middle of base continuing to apex or coalescing inconspicuously near apical fourth, convex interstriae shallowly, sparsely punctured, more often almost impunctate. Ventral surface with prosternum, except prosternal process, coarsely punctate; first abdominal segment longitudinally sulcate; abdominal sternites feebly punctate; apex of last visible abdominal sternite truncate (♂) or rounded with an external tooth on each side (♀). Aedeagus similar to *nutalli* (Fig. 138). Length 14–23 mm.

Hosts. Known from lodgepole pine (*Pinus contorta*), sugar pine (*P. lambertiana*), ponderosa pine (*P. ponderosa*), and Douglas-fir (*Pseudotsuga menziesii*).

Distribution. Southeastern British Columbia to California, Idaho, and Arizona.

Comments. The adults of *laeviventris* may be distinguished from those of *nutalli* by the finely punctate abdominal sternites, by the characteristics of the elytral markings, which are less transverse and interrupted in *laeviventris*, by the ventral maculations of *nutalli*, which are present on the coxae and legs as well as extensively throughout, and by the less strongly convex elytral interstriae of *laeviventris*.

This species is closely related to *nutalli* and has been treated as a subspecies of *nutalli* by Helfer (1941). Barr (1971) treated *laeviventris* as a species and his concept is followed here. Because of numerous intermediate forms throughout the range, the status of *laeviventris* may be altered in the future.

Buprestis intricata Casey

Fig. 139; Map 27

Buprestis intricata Casey, 1909:118; Chamberlin 1926:103; Helfer 1941:146; Barr 1971:62.

Buprestis contortae Hopping, 1933:84 (preoccupied by *contorta* Casey, 1909).

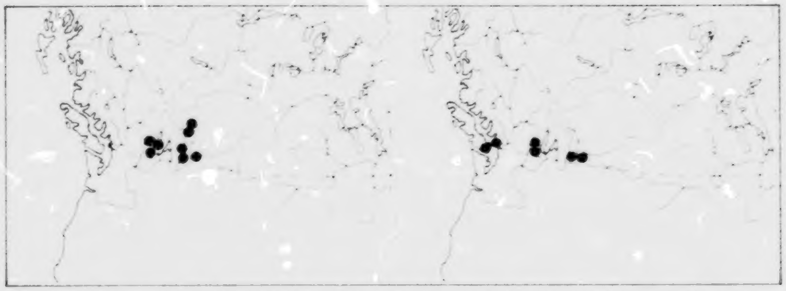
Buprestis murrayanae Hopping, 1934:174 (replacement name).

Description. Green to blue above, suture and lateral margins of elytra often brilliant coppery, varying to uniform reddish coppery above; pronotum often with coppery median line, bright coppery to greenish ventrally. Head with a median line, sometimes with short carina on frons; surface closely, coarsely punctured. Antennae coppery. Pronotum widest at base; sides slightly convergent and straight to middle, then broadly rounded to apex, or evenly arcuately narrowed from base to apex; disc often with smooth, narrow, unimpressed median line, sides broadly, longitudinally impressed; surface coarsely punctate. Elytra wider than pronotum; sides diverging from base to apical third, sometimes slightly sinuate at middle, then broadly rounded or moderately strongly narrowed to apices; apices not emarginate, broadly rounded, sutural angle right; discal striae wide, deeply, coarsely punctured, sometimes strongly transversely rugulose; discal interstriae usually of alternately greater and lesser elevation, surface brightly shining, sparsely punctured; ninth interstriae strongly elevated, eighth sometimes obscured by rugae from adjacent striae. Ventral surface with prosternum flattened or sulcate medianly, strongly punctate; abdominal sternites sparsely, evenly, strongly punctate; apex of last visible abdominal sternite broadly rounded in both sexes. Aedeagus as in Fig. 139. Length 16-21 mm.

Hosts. Recorded from lodgepole pine (*Pinus contorta*) and possibly occurs in other species of pines.

Distribution. Southeastern British Columbia, southwestern Alberta, and the western United States.

Comments. Adults of *intricata* may be distinguished from those of *adjecta*, the most closely related species, by the latter's smaller size and usually by its emarginate to bidentate elytral apices. Also, adults of *intricata* often



Maps 27, 28. 27, Collection localities of *Buprestis intricata*; 28, *B. adjecta*.

have a coppery median line on the pronotum; this line is lacking on adults of *adjecta*. Adults of *aurulenta*, another western species, are colored similarly to *intricata* but normally have only five elytral costae. Some examples of *intricata* have been seen that are entirely green above, with slightly more bluish green along the elytral suture. These specimens closely resemble *langii*, but *intricata* may be distinguished by the rounded elytral apices, not bidentate as in *langii*. Adults vary considerably in color, in number of elytral costae, and somewhat in form.

Buprestis adjecta (LeConte)

Figs. 25, 140; Map 28

Ancylochira adjecta LeConte, 1854:17.
Buprestis adjecta: Chamberlin 1926:103; Helfer 1941:149; Barr 1971:62.
Buprestis brevis Casey, 1909:117.

Description. Elytra green or blue above, with suture and lateral margins coppery, sutural stripe usually much reduced and may be absent, marginal coppery coloration sometimes obsolete, varying to uniform reddish coppery above; pronotum green to blue, varying to metallic red violet; ventral surface bright metallic red violet, varying to green. Head with distinct median sulcus; surface coarsely, densely punctured. Antennae metallic green to black. Pronotum widest at base; sides slightly arcuate to broadly rounded, narrowing to apex; disc with or without longitudinal median impression; surface coarsely punctate, punctures separated by a distance equal to more than their diameters and tending to coalesce into chains of 6–8 punctures. Elytra wider than pronotum, widest near base or on apical third; sides almost parallel to apical third, then broadly rounded to apices; apices more or less strongly emarginate to bidentate; striae about as wide as interstriae, slightly broader toward sides, coarsely punctate and strongly, transversely rugulose, rugae variable; interstriae convex, alternately more strongly elevated, sublateral interstriae very strongly elevated, interstriae near suture nearly impunctate on summits, other interstriae more or less strongly punctate. Ventral surface with prosternum coarsely punctate; abdominal sternites coarsely punctate; apex of last visible abdominal sternite slightly truncate in both sexes. Aedeagus as in Fig. 140. Length 12-15 mm.

Hosts. Recorded from lodgepole pine (*Pinus contorta*), ponderosa pine (*P. ponderosa*), Jeffrey pine (*P. jeffreyi*), and Englemann spruce (*Picea engelmannii*).

Distribution. Southern British Columbia and the western United States.

Comments. This species is closely related to *intricata* and *connexa*, based on the elytral sculpturing. Adults of *adjecta* are distinguished from those of *connexa* by their broader form, by the less regular elytral sculpturing, and by the lack, in most specimens, of the brilliant, metallic red violet coloring of the pronotum. Adults of *intricata* are larger, more oblong, the elytral apices are entire, never emarginate or bidentate, and usually bear bright coppery sutural markings, which are often lacking in *adjecta*.

Nothing is known of the habits of this species. It is not common.

Buprestis connexa Horn

Fig. 141

Buprestis connexa Horn, 1875:148; Chamberlin 1926:107; Helfer 1941:150; Barr 1971:62.

Description. Elytra metallic green to blue, with lateral margins coppery from basal fourth to apex, suture often bluish; pronotum bright metallic red violet, varying to green laterally; head green to red violet coppery; ventral surface green to purple coppery. Head with median line stronger on vertex; surface densely, not coarsely punctate. Antennae black, first two segments usually purple. Pronotum widest at base; sides evenly, arcuately narrowed from base to apex; disc not medially impressed but with smooth, median line; surface coarsely punctured, punctures separated by distance equal to two or three times their diameters. Elytra wider than pronotum, widest slightly behind middle; sides diverging from base to before apical third, then broadly rounded and converging to apices; apices subattenuate to emarginate; striae coarsely punctate, strongly transversely rugulose; interstriae about equally elevated, sparsely punctate. Ventral surface with prosternum more distinctly punctate basally, polished apically; abdominal sternites finely, densely punctate; apex of last visible abdominal segment truncate (♂) or slightly emarginate (♀). Aedeagus as in Fig. 141. Length 13-16 mm.

Hosts. Recorded from ponderosa pine (*Pinus ponderosa*) and Jeffrey pine (*P. jeffreyi*).

Distribution. Western United States from California to eastern Washington and southwestern Idaho; not recorded in Canada but should occur in southern British Columbia.

Comments. Adults of *connexa* may be distinguished from those of *adjecta* by the more commonly metallic red violet color of the pronotum and by the more uniform elevation of the elytral interstriae. See comments under *adjecta*. The only other species with which *connexa* might be confused is *langii*; however, adults of the latter species are generally more elongate, the pronotum is usually broader, with the sides much more strongly arcuate, and the color of the pronotum is never as described here for *connexa*.

This is apparently a rare species; nothing is known of its habits.

Buprestis confluenta Say

Fig. 142; Map 29

Buprestis confluenta Say, 1823:159; Chamberlin 1926:106; Helfer 1941:181; Barr 1971:63.

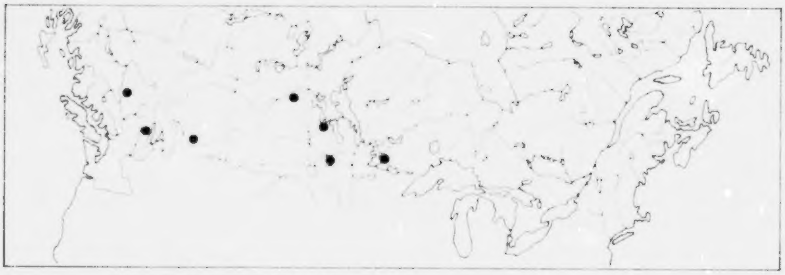
Buprestis confluens LeConte, 1860:206.

Buprestis confluenta tesselata Casey, 1909:104.

Description. Head, pronotum, and elytra golden green to blue or purple, apices of elytra occasionally margined with copper; pronotum sometimes with 4 basal marks; elytra with small, yellow spots irregularly placed, these more or less confluent; head immaculate; ventral surface green to coppery; prosternum often yellow; coxae, legs, sides of mesosternum and metasternum sometimes maculated with yellow; abdomen sometimes with a double row of yellow spots laterally, first sternite often heavily marked. Head sometimes with a median carina, often with small callus on frons; surface coarsely punctate. Antennae green to coppery. Pronotum widest at base or at middle; sides almost evenly arcuately narrowed from base to apex, may be more strongly arcuate or evenly rounded; disc often with smooth, median line, often with levigated spaces usually arranged roughly in pairs, one on each side of middle; surface coarsely, evenly punctate. Elytra wider than pronotum, widest at base or on basal half; sides slightly divergent from base to middle then broadly rounded and arcuately or sinuately narrowed to apex, or sides may converge slightly to middle then rounded and narrowed to apex; apices truncate or oblique or with sutural angles right, sometimes with slight sutural tooth; discal striae finely punctured, distinct; discal interstriae rather broad and feebly convex at base but often narrow and strongly convex at apical fourth, alternating interstriae sometimes more strongly convex, surface finely and very sparsely punctate. Ventral surface with first sternite convex to flattened, not sulcate; abdominal sternites sparsely and finely punctate; apex of last visible abdominal sternite slightly emarginate (♀) or truncate (♂). Aedeagus as in Fig. 142. Length 13–17 mm.

Hosts. Known from quaking aspen (*Populus tremuloides*) and eastern cottonwood (*P. deltoides*).

Distribution. British Columbia to Ontario through the western United States, south to New Mexico and Texas, and east to Illinois.



Map 29. Collection localities of *Buprestis confluenta.*

Comments. This species is unique among all other North American species in the elytral maculation consisting, in this species only, of small yellow spots scattered over the surface in an irregular manner.

Adults of this species attack injured, dead, and dying trees.

Buprestis viridisuturalis Nicolay & Weiss

Fig. 143

Buprestis viridisuturalis Nicolay and Weiss, 1918:100; Chamberlin 1926:128; Helfer 1941:177; Barr 1971:63.
Buprestis viridisuturalis var. *lesnei* Garnett, 1922:12.

Description. Head and pronotum green to blue or rarely purple; elytra yellow to light yellow brown, with sutural stripe metallic green, blue, or rarely purple, varying from narrowly metallic on suture to sutural stripe expanded just behind middle and reaching lateral margin, which is often green, and with a lesser expansion on apical fourth, this sometimes reaching lateral margin, nearly coalescing with marginal green to form an enclosed apical spot at apical third; head and pronotum immaculate; ventral surface immaculate except sometimes a pair of yellow spots present on last abdominal sternite, surface green, blue, or purple, some orange may be present. Head often with median line; surface densely punctured and pubescent; eyes extremely large, prominent in male. Antennae metallic green to purple. Pronotum widest at or a little behind middle, more quadrate in male; sides about evenly arcuate from base to apex; disc often with a median line; surface coarsely, evenly punctate, more closely at sides. Elytral wider than pronotum, broadest at base; sides parallel from base to apical third and arcuately narrowed to apex, or sides arcuate from base to apex; apices truncate with an external tooth to bidentate, or emarginate; discal striae coarsely punctured, sometimes dark; discal interstriae weakly convex at most, finely, sparsely punctate. Ventral surface with first abdominal sternite convex, not sulcate; abdominal sternites finely, sparsely punctate; apex of last visible abdominal sternite bisinuate to truncate in both sexes. Aedeagus as in Fig. 143. Length 11-15 mm.

Hosts. Recorded from black cottonwood (*Populus trichocarpa*), eastern cottonwood (*P. deltoides*), Fremont cottonwood (*P. fremontii*), and white alder (*Alnus rhombifolia*).

Distribution. Washington to southern California; not recorded from Canada but may occur in southern British Columbia.

Comments. Adults of this species are easily recognized by the color pattern given under description. The species does not resemble any other Canadian species.

This species exhibits the most sexual dimorphism of any of the North American species. The front of the head of the male is longitudinally impressed and the eyes are extremely large and prominent. The sexes also differ in size, shape, and maculation pattern.

Buprestis gibbsii (LeConte)

Fig. 144

Ancylochira gibbsii LeConte, 1857:42.
Buprestis gibbsii: Chamberlin 1926:112; Helfer 1941:175; Barr 1971:63.

Description. Green to blue or, less commonly, purple; ventral surface green, sometimes suffused with purple, immaculate; elytra with large, elongate, and irregular-shaped yellow spot before middle, extending in slightly oblique direction from near suture to humeri, dividing at and sometimes encircling humeri or curving around outside; a yellow fascia behind middle usually attaining lateral margins but not suture, rarely divided into two spots, an apical spot extending from side margins transversely to near suture, usually tinged with orange externally. Head often with sulcus on vertex, smooth line on frons becoming a carina on many specimens; surface coarsely and closely punctate; eyes more prominent in males. Antennae dark metallic green to purplish or blue. Pronotum widest at middle; sides almost straight to slightly arcuate from base to middle, then more acutely narrowed to apex or almost evenly arcuate from base to apex; disc often with fine, longitudinal median groove, usually bordered by narrow, impunctate area; surface coarsely, irregularly punctate. Elytra wider than pronotum, widest at base or on apical third; sides from apical third almost straight to slightly arcuately narrowed to apex; apices bidendate; discal striae distinct; discal interstriae finely sparsely punctate and only slightly convex. Ventral surface with first abdominal sternite smooth medianly, not sulcate; abdominal sternites finely, sparsely punctate, more coarsely on last segment; apex of last visible abdominal sternite truncate in both sexes. Aedeagus as in Fig. 144. Length 14.5–20 mm.

Hosts. Oregon white oak (*Quercus garryana*) and California black oak (*Q. kelloggii*).

Distribution. Western Washington to southern California; not yet recorded from Canada but should occur on southern Vancouver Island and in scattered localities in extreme southern British Columbia.

Comments. This species is included here because one of its hosts, *Quercus garryana*, occurs in that section of the Coast Forest region along the east coast of Vancouver Island and on adjacent islands, and at two locations on the mainland, one on Sumas Mountain and the other at Yale in the Fraser Canyon. Although not yet recorded from Canada, it is reasonable to assume the species will eventually be taken at one of the preceding localities.

Adults of this species are easily recognized by the six elytral spots and the immaculate ventral surface. Adults of *langii* and *fasciata* have similar elytral markings but the anterior spot never curves around the humeri as in *gibbsii*, and the apical and middle spots do not have any tinge of orange. In addition, the striae of *langii* and *fasciata* are transversely rugulose, and the anterior tibiae of the male are not modified by any internal emargination and subapical tooth such as found in *gibbsii*.

Genus *Melanophila* Eschscholtz

This genus contains 17 North American species, eight of which are known to definitely occur in Canada. Several species are very common and two western species are significant pests that kill trees weakened by drought, pollution, fire, or other injury. Some species are attracted to smoke and are known colloquially as "fire bugs"; these beetles swarm to forest fires and lay their eggs on the scorched, sometimes still smoldering trees.

Members of *Melanophila* breed principally in coniferous trees, although *occidentalis* Obenberger attacks oaks and other broad-leaved trees and shrubs. Details of the life history are not well known except for those species that are particularly important economically. Known details are given in the various species treatments.

Description. Body oval, about three times longer than wide; black or greenish, occasionally marked with yellow spots. Head evenly convex, closely punctured; eyes widely separated; antennae serrate, often reaching hind angles of pronotum, first segment oval, second segment shorter than third, segments 3-11 subtriangular (Fig. 35). Pronotum evenly rounded laterally, disc flattened, densely punctured. Scutellum small, triangular. Elytra slightly wider than pronotum, narrowly rounded to apex; apex acute to narrowly rounded; disc not striate, densely, randomly punctate-granulate. Ventral surface finely punctured; prosternal process with sides arcuate, widened behind procoxae, flat, densely punctured. First abdominal sternite convex, sternites 2–4 subequal in width, fifth sternite subtriangular; apex truncate (♀) or shallowly emarginate (♂).

Comments. This genus was revised by Sloop (1937) and the western species were treated by Barr (1971). Sloop placed the North American species in three subgenera, *Phaenops*, *Melanophila*, and *Xenomelanophila*. Barr (1971) also recognized the three subgenera. Only species in subgenera *Melanophila* and *Phaenops* occur in Canada.

Nelson (1985) elevated *Phaenops* to full generic status. This change was received too late to be included in the present treatment.

Of the 10 species listed here, *occidentalis* and *consputa* are not yet recorded from Canada. They are included because they may be found in southern British Columbia.

Species in this genus display a great deal of individual and geographic variation. This accounts for the rather large number of aberrations described by Obenberger (1928, 1944). None of these aberrations are recognized as valid species and all have been placed in synonymy.

Key to species of *Melanophila* in Canada

1. Elytra glabrous; metatibiae with row of stiff bristles on lateral margins (Fig. 55); tarsi with several stiff bristles on posterior margin of each segment (Fig. 55); pronotal disc very finely, closely punctured or weakly granulose; mesothoracic pit present (subgenus *Melanophila*) 2

Elytra with numerous fine, short setae; metatibiae with only fine setae on lateral margins (Fig. 56); tarsi with only fine setae on posterior margin of each segment (Fig. 56); pronotal disc transversely strigose or distinctly punctured; mesothoracic pit absent (subgenus *Phaenops*) 4

2. Elytra black, with yellow markings; probably in southern British Columbia .... ***consputa* LeConte** (p. 126)

Elytra solid black, without yellow markings 3

3. Elytral apices acute (Fig. 155); dorsal surface of elytra with dense, irregular, weakly elevated elevations; common in conifers throughout Canada .... ***acuminata* (De Geer)** (p. 128)

Elytral apices acuminate; dorsal surface of elytra more or less convex; rare, in *Quercus*; probably in southern British Columbia .... ***occidentalis* Obenberger** (p. 130)

4. Elytra not costate 5

Elytra weakly costate, especially on apical half 9

5. Elytra green or blue green to purplish or blackish green, always immaculate 6

Elytra bronze to black, frequently with yellow spots or immaculate 7

6. Elytra bright green or blue green to purple; large, 8–14 mm; southern British Columbia .... ***gentilis* LeConte** (p. 131)

Elytra blackish green; small, 6–8 mm; southern British Columbia .... ***intrusa* Horn** (p. 132)

7. Pronotal disc closely punctured; elytra immaculate; small, about 6 mm; Ontario and Quebec .... ***aeneola* Melsheimer** (p. 133)

Pronotal disc densely punctured or transversely strigose; elytra usually with yellow spots but may be immaculate 8

8. Pronotal disc distinctly transversely strigose (Fig. 156); transcontinental .... ***fulvoguttata* (Harris)** (p. 133)

Pronotal disc densely punctured, at most weakly strigose; British Columbia .... ***californica* Van Dyke** (p. 136)

9. Elytra black, usually with yellow spots but often immaculate; transcontinental .... ***drummondi* (Kirby)** (p. 137)

Elytra green, with yellow spots; Ontario to New Brunswick .... ***abies* Champlain & Knull** (p. 139)

Tableau des espèces de *Melanophila* du Canada

1. Élytres glabres; métatibias avec une rangée de soies raides sur les marges latérales (fig. 55); tarses avec plusieurs soies raides sur la marge postérieure de chaque article (fig. 55); disque du pronotum avec une ponctuation dense très fine, ou faiblement granulé; fosse mésothoracique présente (sous-genre *Melanophila*) 2
   Élytres avec plusieurs soies fines et courtes; métatibias avec seulement de fines soies sur les marges latérales (fig. 56); tarses avec seulement de fines soies sur la marge postérieure de chaque article (fig. 56); disque du pronotum transversalement ridé ou distinctement ponctué; fosse mésothoracique absente (sous-genre *Phaenops*) 4
2. Élytres noirs, avec des taches jaunes; probablement dans le sud de la Colombie-Britannique .... ***consputa* LeConte** (p. 126)
   Élytres complètement noirs, sans taches jaunes 3
3. Apex de chaque élytre aigu (fig. 155); surface dorsale des élytres avec de faibles élévations denses et irrégulières; commun dans les conifères à travers le Canada .... ***acuminata* (De Geer)** (p. 128)
   Apex des élytres acuminé; surface dorsale des élytres plus ou moins convexe; rare, dans les *Quercus*; probablement dans le sud de la Colombie-Britannique .... ***occidentalis* Obenberger** (p. 130)
4. Élytres sans costae 5
   Élytres avec de faibles costae surtout sur la moitié apicale 9
5. Élytres verts ou bleu-vert à violacés ou vert noirâtre, sans taches 6
   Élytres bronzés à noirs, souvent avec des taches jaunes ou sans taches ... 7
6. Élytres vert brillant ou bleu-vert à violet; de grande taille, 8–14 mm; sud de la Colombie-Britannique .... ***gentilis* LeConte** (p. 131)
   Élytres vert noirâtre; de petite taille, 6–8 mm; sud de la Colombie-Britannique .... ***intrusa* Horn** (p. 132)
7. Disque du pronotum densément ponctué; élytres sans taches; de petite taille, environ 6 mm; Ontario et Québec .... ***aeneola* Melsheimer** (p. 133)
   Disque du pronotum densément ponctué ou transversalement ridé; élytres généralement avec des taches jaunes mais parfois sans taches 8
8. Disque du pronotum avec des rides transverses distinctes (fig. 156); transcontinental .... ***fulvoguttata* (Harris)** (p. 133)
   Disque du pronotum densément ponctué, au plus faiblement ridé; Colombie-Britannique .... ***californica* Van Dyke** (p. 136)
9. Élytres noirs, avec ou sans taches jaunes; transcontinental .... ***drummondi* (Kirby)** (p. 137)
   Élytres verts, avec des taches jaunes; Ontario jusqu'au Nouveau-Brunswick .... ***abies* Champlain & Knull** (p. 139)

Melanophila consputa LeConte

Fig. 146

Melanophila consputa LeConte, 1857:44; Sloop 1937:6; Barr 1971:65.
Melanophila consputa ab. *monochroa* Obenberger, 1928:209.
Melanophila consputa ab. *isolata* Obenberger, 1928:209.
Melanophila consputa ab. *franciscana* Obenberger, 1944:318.
Melanophila consputa ab. *occitanea* Obenberger, 1944:318.
Melanophila consputa ab. *chamberlini* Obenberger, 1944:318.

Description. Black dorsally, with about 5 to 6 yellow spots on each elytron, ventral surface, legs, antennae black. Frons convex, densely punctured, surface between punctures brightly shining; epistoma deeply notched. Antennae extending to hind angles of pronotum; third segment slightly longer than second. Pronotum widest in front of middle; lateral margins broadly arcuate; disc flattened or weakly longitudinally impressed; surface with network of fine, weakly elevated, anastomosing lines, these more prominent laterally, surface between lines dull black, reticulate. Elytra broader than pronotum, sides weakly divergent or weakly undulating on anterior two-thirds, then broadly rounded to subobtuse apex; dorsal surface densely granulate-punctate, noncostate. Ventral surface shining, weakly granulate-punctate; apex of last visible abdominal sternite emarginate (♂) or acutely rounded (♀). Aedeagus as in Fig. 146. Length 9.0–11.0 mm.

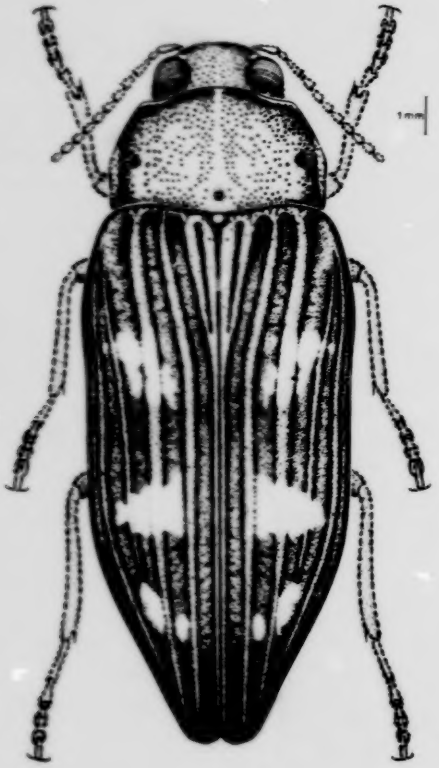
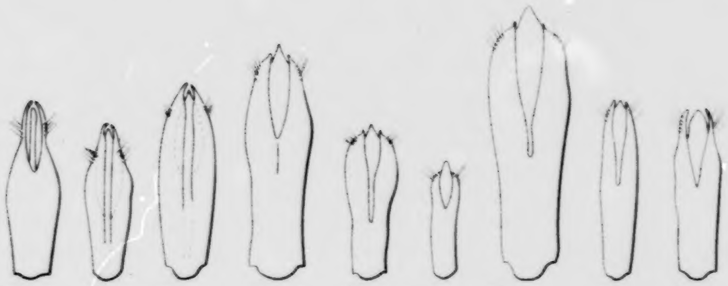


Fig. 145. *Buprestis nutalli.*



Figs. 146–154. Aedeagi of *Melanophila* spp. (redrawn from Sloop 1937). 146, *M. consputa*; 147, *M. acuminata*; 148, *M. occidentalis*; 149, *M. gentilis*; 150, *M. intrusa*; 151, *M. aeneola*; 152, *M. fulvoguttata*; 153, *M. californica*; 154, *M. drummondi*.

Hosts. Known from lodgepole pine (*Pinus contorta*) and ponderosa pine (*P. ponderosa*); probably occurs in other species of pine in its range.

Distribution. California and Arizona north to eastern Washington and northern Idaho; not yet recorded from Canada but may occur in southern British Columbia.

Comments. Adults of this species are easily distinguished from others in the subgenus by the presence of five or six yellowish spots on each elytron.

This species is known colloquially as the "charcoal beetle." It is commonly reported swarming to fires or other sources producing an acrid smoke.

Details of the life history of this species are unrecorded.

Melanophila acuminata (De Geer)

Figs. 35, 55, 147, 155; Map 30

Buprestis acuminata De Geer, 1774:133.

Melanophila acuminata: Knull 1925:23; Chamberlin 1926:209; Sloop 1937:8; Craighead 1950:196; Barr 1971:65.

Buprestis morio Fabricius, 1792:210.

Buprestis appendiculata Fabricius, 1792:210.

Buprestis longipes Say, 1823:164.

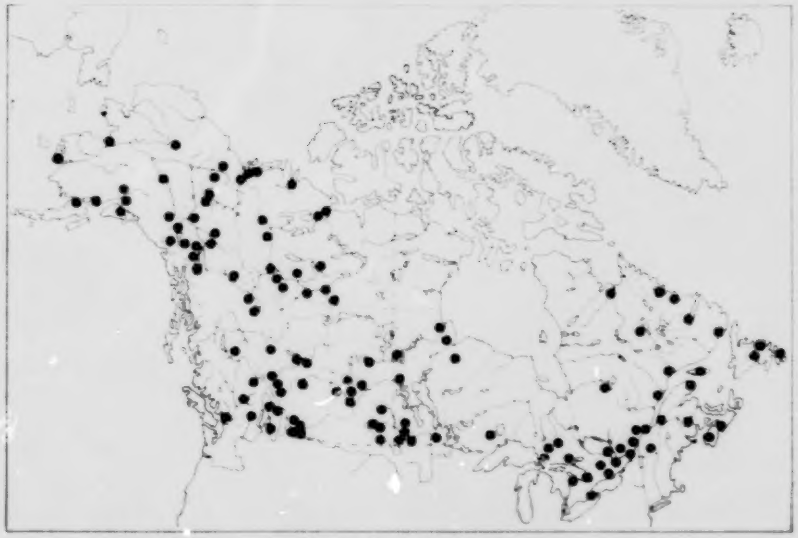
Melanophila immaculata Mannerheim, 1837:70.

Description. Black dorsally and ventrally, weakly shining. Frons convex, weakly longitudinally impressed, densely punctured, weakly shining over entire surface; epistoma moderately deeply notched. Antennae extending to slightly beyond hind angles of pronotum; third segment almost twice as long as second. Pronotum widest in front of middle; lateral margins broadly arcuate; disc flattened or weakly longitudinally impressed; surface dull, reticulate-granulate and finely punctate in median portion, distinctly, shallowly punctured laterally. Elytra broader than pronotum, sides weakly divergent to weakly undulating on anterior two-thirds, then broadly rounded to serrate, acute apices; dorsal surface densely, finely granulate or granulate-punctate, noncostate, usually with broad, irregular elevations. Ventral surface weakly shining to dull, weakly punctate; apex of last visible abdominal sternite broadly emarginate (♂) or acutely rounded (♀). Aedeagus as in Fig. 147. Length 8.0–12.0 mm.

Hosts. All species of conifers in its range.

Distribution. Throughout the coniferous forest from Alaska to Newfoundland, south into Mexico and Cuba; also occurs in Europe and Asia.

Comments. Adults of this species are easily recognized by the uniform, dull black color on both dorsal and ventral surfaces, by the dull, minutely granulate-reticulate pronotal disc, and by the acute elytral apices. It is distinguished from *consputa* by the lack of elytral spots, and from *occidentalis* by the acute, not acuminate, elytral apices, and by the weakly elevated, broad elevations on the elytral surface.



Map 30. Collection localities of *Melanophila acuminata*.

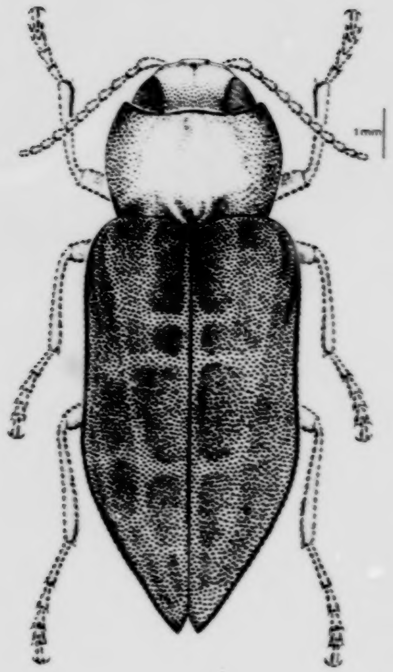


Fig. 155. *Melanophila acuminata.*

The larvae have been described and illustrated by Benoit (1966*b*).

Although this is one of the most common species of *Melanophila* in North America, very little is known of its life cycle. It occurs in all species of conifers in North America.

The infrared (heat) receptors of this species have been investigated and figured by Evans and Kuster (1980).

Melanophila occidentalis Obenberger

Fig. 148

Melanophila occidentalis Obenberger, 1928:209; Sloop 1937:10; Barr and Linsley 1947:163; Barr 1971:65.

Description. Similar to *acuminata* but differs by elytral surface being more or less evenly convex and elytral apices acuminate. Aedeagus as in Fig. 148.

Hosts. Recorded from oak (*Quercus* spp.). In the United States, this species is recorded from a number of nonconiferous trees and shrubs, none of which occur in Canada.

Distribution. Southern British Columbia to Baja California, east to Utah and Arizona.

Comments. No specimens of this species have been seen from Canada, although Barr (1971) records southwest British Columbia in the range of *occidentalis*. The hosts are various species of oak (*Quercus*), especially, in Canada, *Q. garrayana*.

Adults are similar to those of *acuminata* but may be distinguished by the characters given in the key and in the description.

Other than the host plants, nothing is known about the life history of this species.

Melanophila gentilis LeConte

Fig. 149; Map 31

Melanophila prasina LeConte, 1860:254 (preoccupied).

Melanophila gentilis LeConte, 1863:42; Chamberlin 1926:218; Sloop 1937:14; Anderson 1966:251; Barr 1971:66.

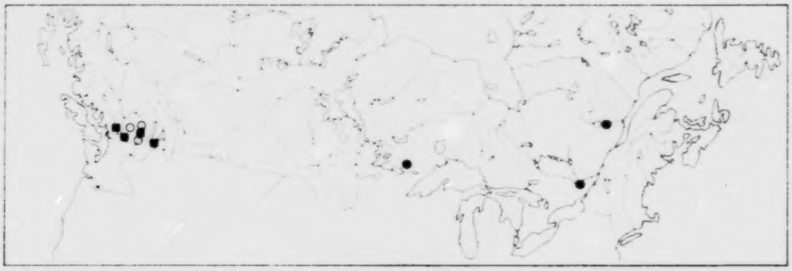
Description. Green, blue green to purplish dorsally, coppery to greenish ventrally, antennae usually darker. Frons convex, densely punctured, surface between punctures brightly shining. Antennae extending to slightly beyond hind angles of pronotum; third segment almost as long as first and second combined. Pronotum widest in front of middle; lateral margins evenly, moderately arcuate; disc convex; surface densely punctured, punctures rather large, very close, sometimes those in median area transversely contiguous, interpuncture spaces, then transversely elevated. Elytra broader than pronotum, sides weakly divergent or weakly undulating on anterior two-thirds, then broadly rounded to subobtuse apex; dorsal surface densely granulate-punctate, setose, noncostate. Ventral surface shining, weakly granulate-punctate; apex of last visible abdominal sternite emarginate (♂) or acutely rounded (♀). Aedeagus as in Fig. 149. Length 8.0–14.0 mm.

Hosts. Recorded from lodgepole pine (*Pinus contorta*) and ponderosa pine (*P. ponderosa*), plus other species of pines in the United States.

Distribution. Southern British Columbia to California, eastward to the Black Hills in South Dakota.

Comments. This is one of the most distinctive species in the genus. Adults are easily recognized by the greenish, bluish, or purplish color and by the large, robust size. It is common in the Pacific Coast region.

This species is usually found infesting felled trees and logs, windfalls, and injured trees or is found as a secondary invader in the bole of standing trees. The larvae are primarily bark-boring in habit and rarely enter the wood.



Map 31. Collection localities of *Melanophila gentilis* (■), *M. intrusa* (○), and *M. aeneola* (•).

On reaching maturity, the larvae work out into the outer bark and pupate in oval cells close to the surface. The species is apparently univoltine (Furniss and Carolin 1977).

Melanophila intrusa Horn

Fig. 150; Map 31

Melanophila intrusa Horn, 1882:105; Chamberlin 1926:219; Sloop 1937:12; Barr 1971:66.

Description. Blackish green to black with greenish reflections or dark coppery with greenish tint dorsally, more greenish ventrally. Frons strongly convex, densely, closely punctured, punctures somewhat elongate, surface between punctures brightly shining. Antennae not reaching hind angles of pronotum; third segment longer than second and distinctly longer than fourth. Pronotum widest at middle; lateral margins slightly arcuate; disc somewhat convex, flattened, or weakly impressed posteriorly; surface densely punctured, punctures of moderate size, almost touching, interpuncture surface shining, occasionally dull, reticulate. Elytra broader than pronotum, sides nearly straight on anterior two-thirds, then broadly rounded to subobtuse, serrate apices; dorsal surface densely punctate-granulate, setose, noncostate. Ventral surface shining, weakly, closely punctured; apex of last visible abdominal sternite emarginate (♂) or acutely rounded (♀). Aedeagus as in Fig. 150. Length 6.0–8.0 mm.

Hosts. Recorded from limber pine (*Pinus flexilis*) and ponderosa pine (*P. ponderosa*), plus other American species of pines. One specimen has been seen from Douglas-fir (*Pseudotsuga menziesii*).

Distribution. Southern British Columbia through the western United States.

Comments. This is a relatively rare species in Canada. Adults are most easily distinguished by the small size and by the dark metallic greenish color. Adults are similar to those of *aeneola*, but *intrusa* may be distinguished by the more greenish color and by the western distribution.

Nothing is known of the habits or life history of this species.

Melanophila aeneola Melsheimer

Fig. 151; Map 31

Melanophila aeneola Melsheimer, 1845:146; Knull 1925:25; Chamberlin 1926:212; Sloop 1937:12; Craighead 1950:196.

Description. Shining black dorsally, elytra immaculate, sometimes pronotum dark greenish, ventral surface, legs, antennae black to greenish black. Frons strongly convex, densely punctured, surface brightly shining; epistoma weakly emarginate. Antennae not reaching hind angles of pronotum; third segment about two times longer than second or fourth. Pronotum widest at base; lateral margins weakly arcuate; disc convex, slightly flattened at base; surface densely punctured, punctures large, shallow, and very close, shining. Elytra wider than pronotum, sides weakly constricted on anterior third, subparallel to anterior two-thirds, then broadly rounded to subobtuse apices; dorsal surface densely punctate–granulate, setose, noncostate. Ventral surface shining, weakly punctured; apex of last visible abdominal sternite weakly emarginate or truncate (♂) or acutely rounded (♀). Aedeagus as in Fig. 151. Length 5.0–6.5 mm.

Hosts. Recorded in Canada only from jack pine (*Pinus banksiana*). Reported from Virginia pine (*Pinus virginiana*) by Chamberlin (1926).

Distribution. Ontario and Quebec, south to Florida, west to Indiana.

Comments. This species is widespread in eastern North America but is evidently not common. Adults closely resemble those of *intrusa*, but they differ by the darker color and by their eastern distribution.

Evidently, nothing is known of the habits or life history of this species.

Melanophila fulvoguttata (Harris)

Figs. 56, 152, 156; Map 32

Buprestis fulvoguttata Harris, 1829:2.

Melanophila fulvoguttata: Knull 1925:23; Chamberlin 1926:216; Sloop 1937:15; Craighead 1950:195; Anderson 1966:251; MacAloney 1967:4; Baker 1972:168, 169.

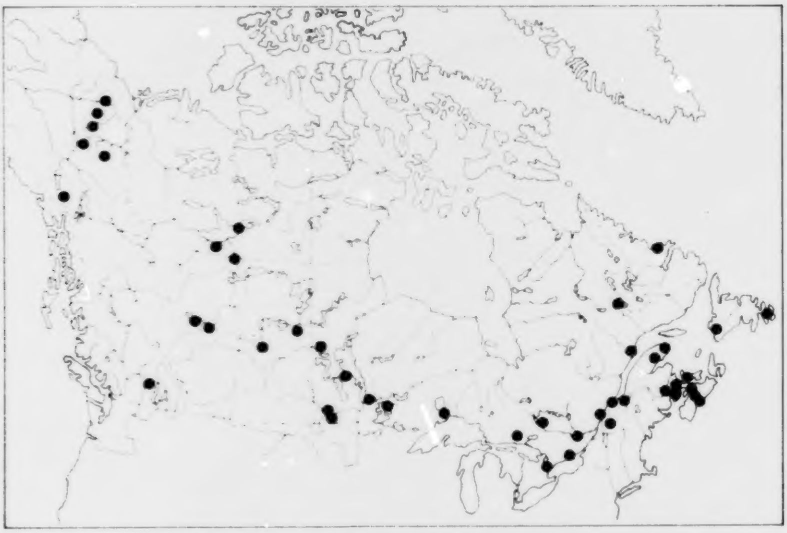
Apatura octospilata Laporte and Gory, 1837:4.

Apatura croceosignata Laporte and Gory, 1837:5.

Apatura decolorata Laporte and Gory, 1837:5.

Melanophila pacifica Obenberger, 1944:320.

Melanophila harrisi Obenberger, 1944:320.



Map 32. Collection localities of *Melanophila fulvoguttata*.

Description. Black dorsally, with 3 small, yellow spots on each elytron or frequently immaculate, ventral surface, legs, antennae black. Frons strongly convex, densely punctured, brightly shining; epistoma very shallowly emarginate. Antennae extending to hind angles of pronotum; third segment about two times longer than second, definitely longer than fourth. Pronotum widest in front of middle; lateral margins weakly arcuate, weakly converging posteriorly; surface strongly to moderately strongly, transversely strigose in middle, more distinctly punctured or longitudinally strigose laterally, strigula sometimes obscure, then punctures tending to form short, transverse grooves. Elytra wider than pronotum, sides weakly divergent on anterior two-thirds, then broadly rounded to subobtuse apices; dorsal surface densely, deeply punctured, interpuncture spaces convex, noncostate. Ventral surface shining, densely, finely punctured; apex of last visible abdominal sternite broadly rounded to truncate (♂) or acutely rounded (♀). Aedeagus as in Fig. 152. Length 8.0–12.0 mm.

Hosts. Recorded from balsam fir (*Abies balsamea*), tamarack (*Larix laricina*), spruce (*Picea* spp.), eastern white pine (*Pinus strobus*), and eastern hemlock (*Tsuga canadensis*).

Distribution. Transcontinental, and in the northeastern and Lake states, south to North Carolina.

Comments. This species and *drummondi* are often difficult to separate. Typical specimens of *drummondi* are easily distinguished by the costate elytra,

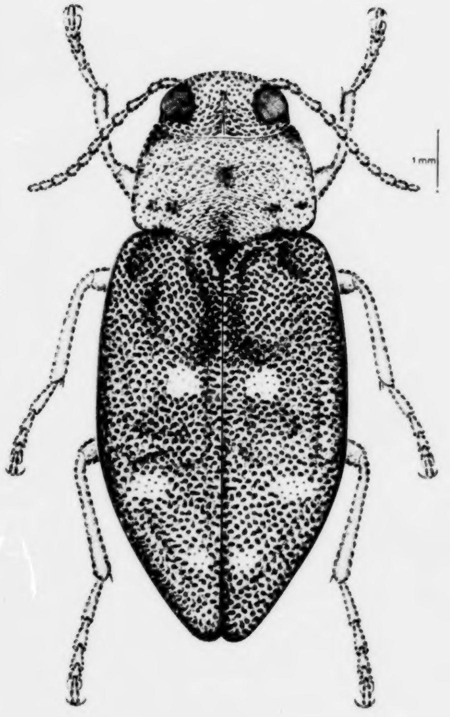


Fig. 156. *Melanophila fulvoguttata.*

but this feature is variable and is not readily seen on many specimens. It appears that some degree of integradation (hybridization) may occur between the two species, because many intermediate specimens have been seen. Sloop (1937) states that the male genitalia of the two species are distinctive, but I have not found this to be so. The male genitalia of both species are similar. Some minute differences were seen on the styli on the female genitalia of the two species. In general, specimens of *fulvoguttata* can be distinguished by the noncostate elytra, by the transversely strigose pronotal disc, and often by host and distribution.

The life history has been reported by MacAloney (1967). Adults appear from late spring to late summer and deposit their eggs in bark crevices on weakened, dead, or dying trees or on logs and wind-thrown trees in which the cambium is still moist. The larvae bore into the cambium layer where they construct winding frass-filled galleries. Before becoming full-grown, they construct cells in the outer bark in which they spend the winter in the prepupal stage. Pupation occurs in the spring. The life cycle may take 1-2 years. Apparently the mature larvae require a winter diapause before pupation. Larvae from eggs laid late in the season spend the following summer feeding, overwinter as prepupae, and pupate the following spring.

The larvae have been described and illustrated by Benoit (1966*b*).

MacAloney (1967) shows the Canadian range of this species to be from southern Lake Superior, east throughout southern Ontario, and eastward. Numerous specimens of this species have been seen from as far west as Yukon Territory. Thus, this species has a considerably larger area of distribution than formally believed.

Melanophila californica Van Dyke

Fig. 153

Melanophila californica Van Dyke, 1918:54; Chamberlin 1926:213; Sloop 1937:16; Anderson 1966:251; Barr 1971:66.

Melanophila californica ab. *tetrastictula* Obenberger, 1944:319.

Melanophila californica ab. *monostigma* Obenberger, 1944:319.

Melanophila californica ab. *vandykeana* Obenberger, 1944:319.

Description. Similar to *fulvoguttata* except pronotal disc distinctly, randomly punctured, with no indications of strigula or short, transverse, punctate grooves, and elytral spots, if present, somewhat larger. Aedeagus as in Fig. 153.

Hosts. Known only from ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsugae menziesii*).

Distribution. Southern British Columbia to California, east to Idaho.

Canadian record. Oliver, B.C., Douglas-fir (*Pseudotsugae menziesii*).

Comments. This species is known as the California flatheaded borer. The following biology is condensed from Lyon (1970).

This species is a serious pest and is capable of killing a tree by itself. Usually, however, it is associated with other serious pests such as the western pine beetle, *Dendroctonus brevicomis* LeConte, or the pine engraver *Ips pini* (Say) (Scolytidae). Trees that survive the attack of the borer may subsequently be killed by bark beetles and vice versa.

The California flatheaded borer usually attacks living trees and continues development in trees when they are felled or killed by other agents. This species may also continue development in large limbs or tops left as logging slash. Attacks may be found on the entire length of the tree and on the basal port of large limbs or may be found only at the top or along one side of the bole. All age classes above sapling or pole stage may be attacked.

Adult beetles fly from May to August, with the peak flight usually during June or July, depending on local conditions. Adults feed on green foliage. Egg laying occurs during June through August. Eggs are placed under bark scales bordering on crevices. Most of the eggs are deposited singly or in pairs but many may be laid in groups of three to eight. Eggs hatch in 1-3 weeks.

The newly hatched larva bores directly to the cambium layer, then turns and mines through the phloem tissue next to the wood. As the larva grows, the mine gradually increases in width. The larva may grow steadily throughout the season and reach the prepupal stage in one summer or it may grow very slowly throughout the season and overwinter in this stage. The latter condition is termed "incipient"; the mine an incipient larva makes is often healed over by the tree, forming warty ridges. An incipient larva may survive for 2-4 years but mortality is high; if the larva survives this stage, a period of rapid growth takes place.

The full-grown larva constructs a pupal cell in the outer bark, stops feeding, and becomes a prepupa. Overwintering generally occurs as prepupae, but active feeding larvae may sometimes pass the winter. Pupation takes place the following spring from May to July. The pupal stage lasts about a month.

Competition for space and food often causes high mortality of borer larvae. Hymenopterous parasites infest the eggs and larvae, and *Thanasimus lecontei* Wolcott and *Temnochila virescens* (Fabricius) have been observed feeding on borer larvae. Woodpeckers are also an important natural control factor.

Adults of this species are similar to those of *fulvoguttata* and *drummondi*. The adults of *californica* are most easily distinguished by the densely, randomly punctured pronotal disc. The pronotal disc of the other two species is more or less transversely strigose. The limited Canadian distribution and the host will also aid in its recognition.

Melanophila drummondi (Kirby)

Figs. 1, 154; Map 33

Buprestis drummondi **Kirby, 1837:159.**

Melanophila drummondi**: Knull 1925:23; Chamberlin 1926:214; Sloop 1937:16; Craighead 1950:196; Anderson 1966:251; Barr 1971:66.**

Buprestis umbellatarum **Kirby, 1837:159.**

Melanophila guttulata **Mannerheim, 1853:221.**

Melanophila drummondi **ab. *tristicula* Obenberger, 1928:209.**

Melanophila drummondi **ab. *plagifera* Obenberger, 1944:320.**

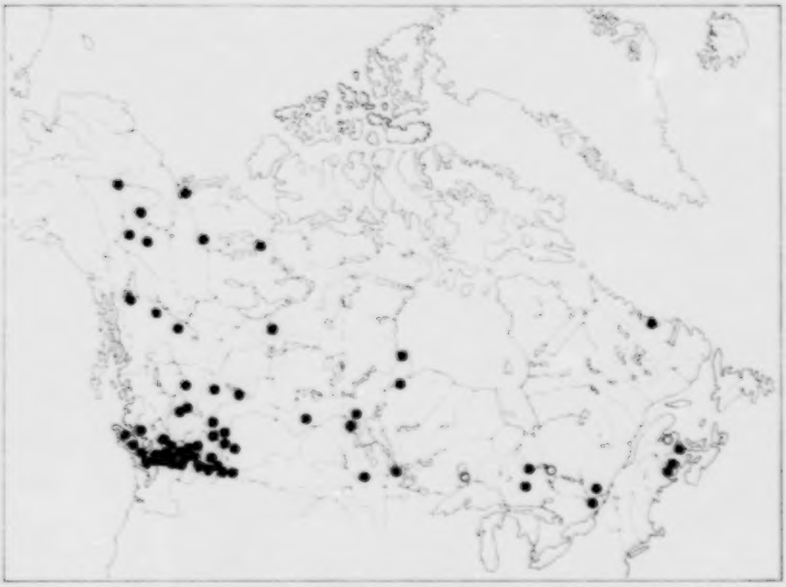
Melanophila drummondi **ab. *lanchesteri* Obenberger, 1944:320.**

Melanophila drummondi **ab. *nicolayi* Obenberger, 1944:320.**

Melanophila drummondi **ab. *quirsfieldi* Obenberger, 1944:320.**

Melanophila drummondi **ab. *monostictula* Obenberger, 1944:320.**

Description. Black dorsally, with 3 or 4 small, yellow spots on each elytron or frequently immaculate, ventral surface, legs, antennae black. Frons as in *fulvoguttata*. Pronotum as in *fulvoguttata* except strigula usually more strongly, sharply elevated. Elytra as in *fulvoguttata* except surface with 3 distinct to indistinct longitudinal costae, these may be very weak to almost absent. Ventral surface as in *fulvoguttata*. Aedeagus as in Fig. 154. Length 8.0-12.0 mm.



Map 33. Collection localities of *Melanophila drummondi* (•) and *M. abies* (○).

Hosts. Recorded from fir (*Abies* spp.), larch (*Larix* spp.), spruce (*Picea* spp.), Douglas-fir (*Pseudotsuga menziesii*), and hemlock (*Tsuga* spp.); rarely pine (*Pinus* spp.).

Distribution. Transcontinental, but more common in the west, extending south to Arizona in the west and into the northeastern states in the east.

Comments. Adults of this species are similar to those of *fulvoguttata* but most *drummondi* adults can be distinguished by the presence of three weak longitudinal costae on each elytron. These costae are more distinct on the specimens from western populations and may be very indistinct on those from eastern populations. In many instances, eastern specimens are indistinguishable from those of *fulvoguttata*.

It appears that in the central portion of the continent, particularly in Manitoba and Saskatchewan, hybridization between *drummondi* and *fulvoguttata* may be occurring. Most specimens from this region are intermediate in male genitalic characters and in elytral characters, resulting in a confusing array of characteristics in the population. This gene flow apparently carries on into the more eastern populations, resulting in the condition described in the previous paragraph.

The biology of *drummondi* is similar to that described for *californica*. Mostly, the adults attack injured, mistletoe-infested, dying, fire-killed, or recently felled trees, but occasionally they kill apparently healthy trees, especially those on dry sites (Furniss and Carolin 1977). The adults of this species are attracted to acetone, and a variety of substances associated with conifers such as ethanol, terpenes, and scolytid phermones (Holsten et al. 1980).

Melanophila abies Champlain & Knull

Map 33

Melanophila drummondi var. *abies* Champlain and Knull, 1923*a*:105; Sloop 1937:14.

Melanophila abies: Chamberlin, 1926:209.

Melanophila abietis Obenberger, 1930:441; Nelson 1980:93.

Description. Identical to *drummondi* except dorsally bluish green; elytral costa weakly indicated.

Hosts. Known only from balsam fir (*Abies balsamea*).

Distribution. Known from Ontario, Quebec, New Brunswick, and New Hampshire.

Comments. This species was originally described as a variety of *drummondi* and is considered in this context by Sloop (1937). Chamberlin (1926) lists it as a full species. Obenberger (1930) treats it as a full species, changing the specific name to *abietis*, which is an unjustified emendation. Nelson (1980) regards it as a full species. I have decided to treat it as a species also. The holotype and paratypes I have examined are certainly distinctive enough to warrant specific treatment. However, I have seen only one specimen besides the type specimens, despite extensive collecting in Quebec and New Brunswick. Specimens of *drummondi* have also been seen that are partly greenish and partly the more typical black, leading one to the conclusion that the greenish color is simply a local color variation in response to a local environmental condition and therefore not worthy of special status. Additional collecting and research is needed to clarify this species problem.

Genus *Xenorhipis* LeConte

This genus contains only one species, which occurs in the eastern United States and may occur in Canada.

Adults are similar to those in *Anthaxia* but are easily recognized by the pectinate male antennae.

Xenorhipis brendeli LeConte

Xenorhipis brendeli LeConte, 1866:384; Knull 1925:22, 67 (illus.); Chamberlin, 1926:244.

Description. Head convex, with broad, median groove; antennae pectinate (♂) or not pectinate (♀); eyes of female smaller, less prominent than those of male. Pronotum slightly wider than long (♂) or much wider than long (♀); apical and basal margins bisinuate. Elytra roughly sculptured, with elevated rugae; sides serrate, more so toward tips, which are separately rounded, broadly impressed on each side at base; each elytron ornamented with a large, pale spot extending nearly one-third of elytra length and which fades into black ground color (after Knull 1925).

Hosts. Reported breeding in hickory (*Hicoria* spp.), and beaten from oak (*Quercus* spp.) and honeylocust (*Gleditsia tricanthos*).

Distribution. Eastern United States, north to Michigan and New York, south to Texas; may occur in southern Ontario.

Comments. This species is included here based on a Michigan record provided by Nelson (pers. comm. 1983).

This is a rare species and nothing is known of its habits or life history.

Genus *Anthaxia* Eschscholtz

This genus, in its restricted sense applied here, contains about 18 species in North America, seven of which occur in Canada.

This genus is usually divided into three subgenera, *Anthaxia*, *Agrilaxia*, and *Haplanthaxia*. During the preparation of this book, a number of species of *Anthaxia* (broad sense) were examined, along with representatives of related genera. I have decided to restrict *Anthaxia* to those species that formed the subgenus *Anthaxia* and have elevated *Haplanthaxia* and *Agrilaxia* to generic status.

Bily (1982) treats *Anthaxia* as one large genus with seven subgenera, including *Anthaxia, Haplanthaxia, Melanthaxia, Agrilaxia*, and several others that do not occur in North America. Species in the subgenus *Melanthaxia* are characterized by the black to dark bronze color, by the wide body, and by the development in coniferous trees. Our species *inornata, aenescens, aeneogaster*, and *retifer* would be placed in this subgenus if Bily's treatment is followed. The remaining species would stay in their present genera, which would be considered subgenera.

The larvae of *Anthaxia* species bore in branches of injured, dead, and dying fir (*Abies* spp.), pine (*Pinus* spp.), Douglas-fir (*Pseudotsuga menziesii*), and various broad-leaved trees and shrubs. Adults may be found resting on their host plants or on flowers. Their economic importance is nil.

Description. Body stout, broad. Head vertical; frons weakly convex, broadly longitudinally impressed in middle, surface alveolate-granulate. Epistoma sinuate or emarginate in front. Antennae 11-segmented, serrate on segments 4–10, segments 1–3 elongate (Fig. 36). Eyes very large, elongate, inner margins oblique above, closer on vertex than below. Pronotum wider than long; sides more or less evenly arcuate; anterior margin bisinuate; base straight, transverse; surface alveolate, reticulate, or variable. Scutellum moderately large, triangular. Elytra stout; base straight, rounded at humeral angles; sides nearly parallel, not or only very slightly constricted, strongly converging to apex; sides of abdomen not visible when viewed from above; surface granulate, with short, stiff setae. Ventral surface finely punctured; prosternal process short, sides arcuate, widened behind procoxae; first abdominal sternite convex, second equal to or greater in width than third or fourth, fifth subtriangular, apex arcuate. Legs slender; femora weakly swollen at middle; tarsal claws simple, may have tooth at base.

Comments. This genus was revised by Cobos (1958, 1971). Certain taxonomic problems were not solved by Cobos; therefore a complete taxonomic revision is needed.

Regional keys have been prepared by Barr (1971) for the Pacific Northwest species and by Wellso et al. (1976) for species occurring in Michigan. These are useful for adjacent areas in Canada.

Key to species of *Anthaxia* in Canada

1. Pronotum with pair of discal impressions, sometimes these are obscure, and with single impression near each lateral margin (Fig. 163); reticulation on pronotal disc microreticulate; tarsal claws simple 2

Pronotum without discal impressions, occasionally with single impression near each lateral margin; reticulation on pronotal disc usually granulate; tarsal claws simple or with tooth at base 3

2. Black, occasionally with bronzy cast; frons conspicuously clothed with suberect dark brown hairs; reticulations on pronotal disc transverse and frequently weakly developed, without granule; elytra uniformly asperate, not microreticulate; transcontinental .... ***inornata* (Randall)** (p. 142)

Dull coppery; frons clothed with indistinct subflattened white hairs; reticulations on pronotal disc hexagonal and distinct, with internal granule; elytra irregularly rugose or with somewhat meshlike sculpture with pits and creases, microreticulate; British Columbia .... ***aenescens* Casey** (p. 145)

3. Pronotum with discal reticulations coarse, irregular, with inconspicuous internal granulations; mesotrochanters and metatrochanters of male with short, acute tooth 4

Pronotum with discal reticulations fine, small, relatively regular and uniform, without internal granulations or, if present, not distinct; mesotrochanters and metatrochanters of male without conspicuous tooth 6

4. Mesosternum and abdominal segments coppery on sides (♂), or uniformly brassy black (♀); southeastern British Columbia .... ***porella* Barr** (p. 145)

Mesosternum and first abdominal segment brilliant blue, blue green, green to dull blue black 5

5. Ventral surface brilliant blue; elytra with few, white setae on outer margin of humerus; frons obliquely flattened on upper half; probably in southern British Columbia .... ***hatchi* Barr** (p. 146)

Ventral surface blue or blue green, frequently darkened; elytra without white setae on humerus; frons, at most, feebly flattened; southern British Columbia .... ***aeneogaster* Laporte & Gory** (p. 147)

6. Dorsal surface blackish; frons feebly convex, with conspicuous, moderately long, suberect, dark brown hairs; Alaska to southern British Columbia and Manitoba .... ***retifera* LeConte** (p. 148)

Dorsal surface blue to blue green; frons flat to slightly concave, with short, brown to black hairs; southeastern British Columbia .... ***prasina* Horn** (p. 150)

Tableau des espèces d'*Anthaxia* du Canada

1. Pronotum avec une paire d'impressions, parfois obscures, sur le disque et avec une impression près de chaque marge latérale (fig. 163); réticulation sur le disque du pronotum microréticulée; griffes des tarses simples 2

Pronotum sans impressions sur le disque, parfois avec une seule impression près de chaque marge latérale; réticulation sur le disque du pronotum généralement granulée; griffes des tarses simples ou avec une dent à la base .. 3

2. Noir, parfois avec une teinte bronzée; front distinctement couvert de soies subérigées brun foncé; réticulation sur le disque du pronotum transversale et souvent peu développée, non granulée; élytres uniformément rugueux, non microréticulés; transcontinental .... ***inornata* (Randall)** (p. 142)

Cuivré mat; front couvert de soies blanches subaplaties peu distinctes; réticulation hexagonale sur le disque du pronotum et distincte, granulée; élytres irrégulièrement rugueux ou avec une sculpture plutôt en forme de maille avec des fosses et des plis, microréticulés; Colombie-Britannique .... ***aenescens* Casey** (p. 145)

3. Réticulation sur le disque du pronotum grossière, irrégulière, avec granulations internes peu apparentes; mésotrochanters et métatrochanters du mâle avec une courte dent aiguë 4

Réticulations sur le disque du pronotum fines, petites, plutôt régulières et uniformes, sans granulations internes ou, si présentes, non distinctes; mésotrochanters et métatrochanters du mâle sans dent 6

4. Mésosternum et segments abdominaux cuivrés sur les côtés (♂), ou uniformément noir cuivré jaune (♀); sud-est de la Colombie-Britannique .... ***porella* Barr** (p. 145)

Mésosternum et premier segment abdominal bleu brillant, bleu vert, verts à bleu noir terne 5

5. Surface ventrale bleu brillant; élytres avec quelques soies blanches sur la marge externe de l'humérus; front obliquement aplati sur la moitié supérieure; probablement dans le sud de la Colombie-Britannique .... ***hatchi* Barr** (p. 146)

Surface ventrale bleue ou bleu vert, souvent foncée; élytres sans soies blanches sur l'humérus; front au plus faiblement aplati; sud de la Colombie-Britannique .... ***aeneogaster* Laporte & Gory** (p. 147)

6. Surface dorsale noirâtre; front faiblement convexe, avec des soies brun foncé distinctes, modérément longues et subérigées; Alaska jusqu'au sud de la Colombie-Britannique et Manitoba .... ***retifera* LeConte** (p. 148)

Surface dorsale bleue à bleu vert; front plat à légèrement concave, avec de courtes soies brunes à noires; sud-est de la Colombie-Britannique .... ***prasina* Horn** (p. 150)

Anthaxia inornata (Randall)

Figs. 157, 163; Map 34

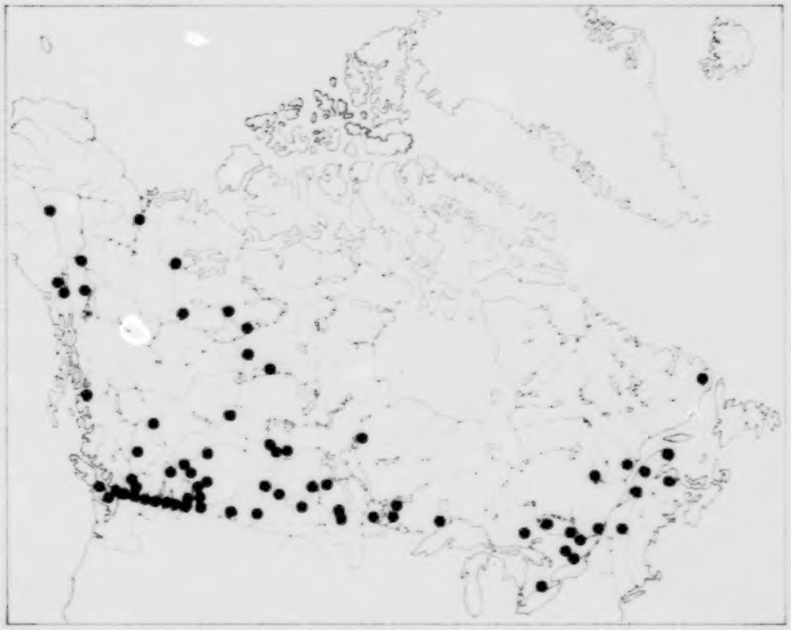
Buprestis inornata Randall, 1838:4.

Anthaxia inornata: Nelson 1985:137.

Anthaxia expansa LeConte, 1857:44; Chamberlin 1926:87 (as synonym of ***aeneogaster***); Cobos 1958:91; Barr 1971:67.

Anthaxia foveicollis LeConte, 1860:215.

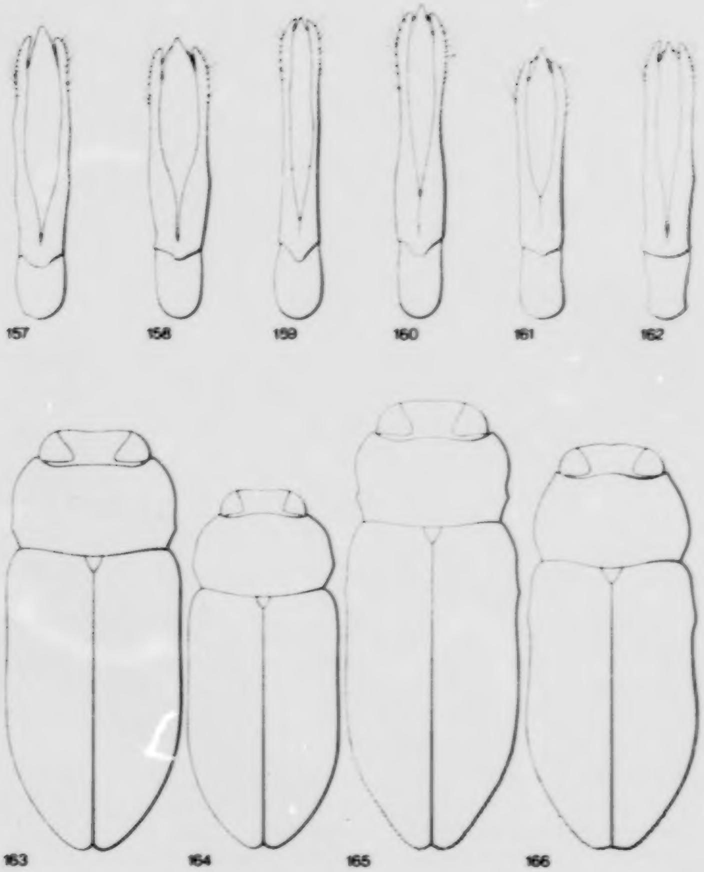
Anthaxia imperfecta LeConte, 1859:215.



Map 34. Collection localities of *Anthaxia expansa*.

Description. Body dorsally black, infrequently bronzy black, sometimes greenish on lateral margins of pronotum; ventrally dark greenish or dark bluish. Head convex, weakly transversely impressed above epistoma; surface densely alveolate, alveoli internally minutely reticulate, sometimes smooth and shining, one short, erect, brownish seta arises from center of each alveolus; epistoma shallowly arcuate in front. Antennae dark brown or black, first three segments cylindrical. Pronotum about 1.8 times wider than long, widest near middle; sides broadly arcuate, more strongly converging anteriorly; disc with two shallow, median, circular impressions, a narrow, shallowly impressed median line and a shallow impression behind middle near each lateral margin; surface alveolate, more distinctly so laterally, alveoli more weakly indicated, transversely arranged, center of alveoli minutely reticulate. Elytra about 1.7 times longer than wide; sides very weakly constricted near middle; weakly expanded on apical third, then converging to narrowly rounded, serrulate apices; surface uneven, densely, evenly minutely reticulate, granulate. Ventral surface finely, sparsely punctate; last visible abdominal sternite broadly rounded (♂) or narrowly, acutely rounded (♀). Tarsal claws simple. Aedeagus as in Fig. 157. Length 4.5–8.0 mm.

Hosts. Breeds in conifers, adults collected from flowers.



Figs. 157–166. 157–162, Aedeagi of *Anthaxia* spp. (redrawn from Cobos 1958); 157, *A. inornata*; 158, *A. aenescens*; 159, *A. porella*; 160, *A. aeneogaster*; 161, *A. retifera*; 162, *A. prasina*; 163–166, dorsal aspect, *Anthaxia* spp.; 163, *A. inornata*; 164, *A. aenescens*; 165, *A. aeneogaster*; 166, *A. prasina*.

Distribution. Alaska to Labrador, throughout the western United States, and probably into eastern United States also.

Comments. This is one of the most common species in Canada. Evidently it has long been confused with *aeneogaster*; therefore published host and locality data cannot be considered accurate.

Adults of this species show considerable variation. The sculpturing of the pronotum may be distinct with the walls of the alveoli very distinct over the entire surface, or the alveoli may be indistinct on the median and anterior portion. The two median impressions on the pronotal disc may be distinct or may be almost completely obsolete. The basic color of the dorsal surface is black but a slight bronzy cast is sometimes evident, and occasionally a greenish reflection is evident on the lateral margins of the pronotum. Ventrally the color varies from dark blackish green to dark blue.

Anthaxia oregonensis Obenberger has been listed as a synonym of *expansa* by most authors, but Barr (1974) states that this synonymy is incorrect.

This species presumably breeds in branches of conifers, although definite host data are unavailable.

Anthaxia aenescens Casey

Figs. 158, 164

Anthaxia aenescens Casey, 1884:175; Chamberlin 1926:87 (as synonym of *aeneogaster*); Cobos 1958:99; Barr 1971:67.

Description. Similar to *expansa* but differs by the more coppery color of the dorsal surface of the body, by the presence of white setae on the frons, and by the presence of a granule in each pronotal alveolus. Aedeagus as in Fig. 158. Length 5.0-6.0 mm.

Hosts. Reared from incense cedar (*Libocedrus decurrens*).

Distribution. British Columbia to California.

Canadian records. Trinity Valley, Chilcotin Lake, and Midday Creek, B.C. (Cobos 1958); Creston and Nicola, B.C.

Comments. This species is not well known because of its confusion with *aeneogaster*.

Anthaxia porella Barr

Fig. 159

Anthaxia porella Barr, 1974:2.

Description. Body brassy black, head dark bluish, sides of pronotum brassy green, elytra, prosternum, and last visible abdominal segment somewhat brassy, humeri bluish (♂) or body uniformly coppery black (♀); ventrally coppery on sides of abdominal sternites (♂) or uniformly brassy black (♀). Head weakly convex, uniformly, coarsely reticulate, with short, stout brown setae; clypeus broadly, shallowly emarginate. Antennae blackish, second segment about 1.5 times longer than third segment. Pronotum widest at middle; disc evenly convex, female with pair of very faint discal impressions; surface uniformly hexagonally reticulate medially and along sides, reticulations more elongate laterally, all reticulations with internal granule. Elytra about 1.7 times longer than wide; sides slightly constricted behind humeri, broadly sinuately narrowed to finely serrate apices; disc subconvex, with pair of shallow, irregular, transverse impressions at base, a pair of shallow impressions at basal third, and longitudinal impressions before apex and along suture; surface roughened at base, weakly roughened elsewhere with rugosities poorly developed, indistinct, with numerous tiny pits arranged serially. Ventral surface reticulate-punctate; last visible abdominal sternite broadly reflexed and broadly rounded. Mesotrochanters and metatrochanters bearing a short, acute tooth (♂) or not toothed (♀). Aedeagus as in Fig. 159. Length 5.2 mm.

Hosts. Recorded only from mountain mahogany (*Cercocarpus ledifolius*).

Distribution. Not definitely established, but specimens assigned to this species by Barr (1974) occur in southeastern British Columbia, Idaho, eastern Oregon, and Washington.

Comments. This species was discussed under the name *simiola* Casey by Barr (1971) and Cobos (1958). Barr (1974) showed that *simiola* was quite different and stated that *porella* is apparently closely related to *wallowae* Obenberger, which was described from one specimen. This species (*porella*) may eventually prove to be a synonym of *wallowae*, but until a complete generic revision is available, the present arrangement must suffice.

Barr (1971) states that *simiola* (now *porella*) is associated with mountain mahogany (*Cercocarpus ledifolius*), and that the adults occur on a number of flowers.

Anthaxia hatchi Barr

Anthaxia hatchi Barr, 1971:72.

Description. Body dark brown, sides of pronotum on apical half and small areas before scutellum coppery; ventral surface blue green to shiny green. Head obliquely flattened on upper half, narrowly longitudinally impressed between upper margins of eyes, reticulations distinct, elongate on upper portion of frons, reticular ridges broad, flattened on upper half, with moderately long, suberect, brown setae on upper half and subdepressed, white hairs on lower half; epistoma emarginate in front. Pronotum widest at middle; disc weakly, longitudinally impressed; surface more or less uniformly reticulate except conspicuously transversely reticulate on apical half, reticulations forming indistinct, treelike branching laterally, weakly developed on anterior half, all reticulations with an internal granule. Elytra about 1.7 times longer than wide; sides subparallel to near apical third, then arcuately narrowed to apex, finely serrate on apical fourth; disc unevenly contoured, densely roughened, without distinct asperities, uniformly clothed with short, suberect, dark brown setae except for patch of white setae near humeri. Ventral surface as in *aeneogaster*. Mesotrochanters and metatrochanters each with a small, acuminate tooth (♂) or not toothed (♀). Length 6.0–7.2 mm.

Hosts. Not recorded.

Distribution. Known only from southeastern Washington and Oregon; probably occurs in southern British Columbia.

Comments. No specimens of this species have been seen. The diagnosis is taken from Barr's (1971) original description, supplemented by the remarks in Nelson et al. (1981). This species is evidently similar to *aeneogaster*, but the adults of *hatchi* are distinguished by the difference in ventral color and by the presence of white setae near the elytral humeri.

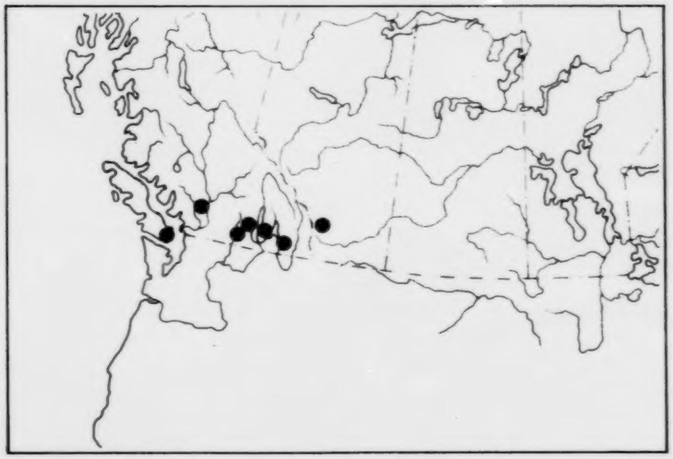
Anthaxia aeneogaster Laporte & Gory

Figs. 36, 160, 165; Map 35

Anthaxia aeneogaster Laporte and Gory, 1841:32; Knull 1925:25; Chamberlin, 1926:87; Craighead 1950:197; Cobos 1958:106; Barr 1971:72.
Anthaxia strigata LeConte, 1860:215.
Anthaxia imperfecta LeConte, 1860:215.
Anthaxia ?aerica Crotch, 1873:89.
Anthaxia grossa Obenberger, 1928:253, 257.

Description. Similar to *hatchi* but differs by the less shiny, variable dark green coloration of the ventral surface, by the absence of white setae near the elytral humeri, and by the more feebly flattened frons. Aedeagus as in Fig. 160. Length 4.0-5.7 mm.

Hosts. Breeds in conifers, especially pine (*Pinus* spp.); adults collected on flowers.



Map 35. Collection localities of *Anthaxia aeneogaster*.

Distribution. Southern British Columbia and Alberta, south through the western United States to Baja California.

Comments. This species has been confused with several other species so often that literature references cannot be considered accurate. A great deal of variation occurs in this species, which accounts for much of the confusion.

The treatment here follows that of Cobos (1958) and Barr (1971), who have sorted out the numerous erroneous interpretations.

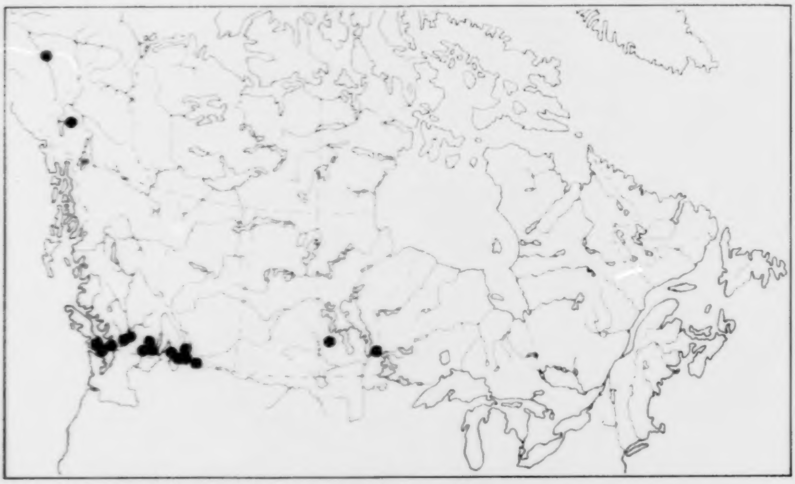
Nothing is known of the biology of this species.

Anthaxia retifera LeConte

Figs. 161, 167; Map 36

Anthaxia retifera LeConte, 1860:215; Chamberlin 1926:87 (as synonym of *aeneogaster*); Cobos 1958:95; Barr 1971:68.

Description. Dorsally black to dark bronze; ventrally dark green. Head weakly convex, without impressions or grooves; surface densely alveolate, alveoli shallow, punctured internally, each bearing a short, erect, curved, brownish seta; epistoma shallowly arcuate in front. Pronotum about 1.8 times wider than long, widest slightly before middle; sides broadly arcuate; disc evenly convex or may be weakly, longitudinally impressed at middle or just in front of scutellum; surface closely alveolate, each alveolus more or less uniform in size, center of alveoli minutely reticulate, not granulate. Elytra about 1.7 times longer than wide; sides weakly constricted near middle, weakly



Map 36. Collection localities of *Anthaxia retifera*.

expanded on apical third, converging to narrowly rounded, weakly serrate apices; surface uneven, minutely reticulate, with numerous, evenly distributed, flattened asperities. Ventral surface finely, sparsely punctured; last visible abdominal sternite broadly rounded in both sexes. Mesotrochanter and metatrochanter not toothed in either sex. Aedeagus as in Fig. 161. Length 5.0–7.5 mm.

Hosts. Known to breed in ponderosa pine (*Pinus ponderosa*), lodgepole pine (*P. contorta*), and knobcone pine (*P. attenuata*); also occurs in other conifers. Adults collected from flowers of various compositae.

Distribution. Alaska and Yukon Territory to southern British Columbia and Manitoba, south to California and New Mexico.

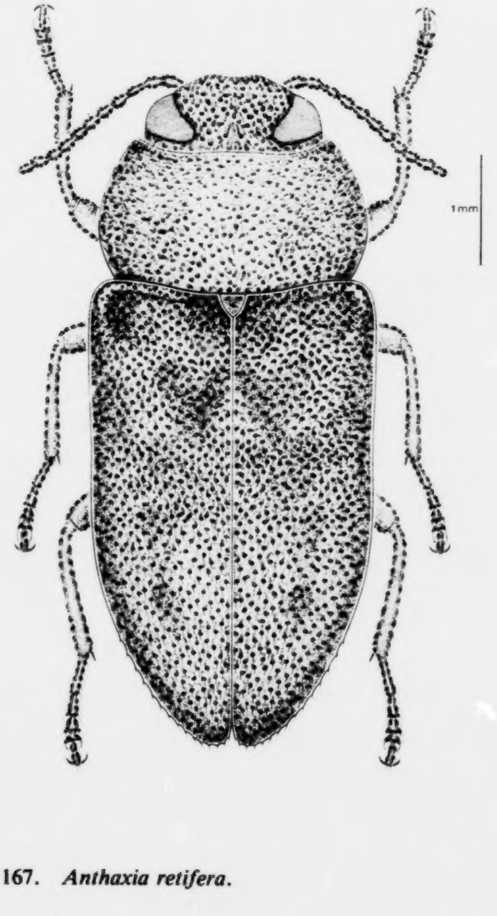


Fig. 167. *Anthaxia retifera*.

Comments. This is evidently a common species in southern British Columbia. Adults are most easily recognized by the even reticulation of the pronotum in which no granules occur in the alveoli and by the lack of a tooth on the mesotrochanter and metatrochanter of the males. It is often difficult to distinguish adults of this species from some adults of *expansa*. In *expansa*, the round pronotal impressions are sometimes extremely obscure and these specimens resemble those of *retifera*. Close examination is required, but one can usually detect the impressions if they are there.

Nothing is known of the biology of this species.

Anthaxia prasina Horn

Figs. 162, 166

Anthaxia prasina Horn, 1882:108; Chamberlin 1926:87 (as synonym of *aeneogaster*); Cobos 1958:100; Barr 1971:71.

Anthaxia falsula Obenberger, 1926:254, 257.

Description. Uniformly green to blue green. Head flat to slightly concave, without impressions or grooves; surface essentially as in *retifera*. Pronotum about 1.6 times wider than long, widest before middle; sides broadly arcuate, occasionally subparallel; disc convex, with short, shallow, longitudinal impression on basal half; surface as in *retifera*. Elytra as in *retifera*. Legs and ventral surface as in *retifera*. Aedeagus as in Fig. 162. Length 4.0–6.5 mm.

Hosts. Unknown. Adults found on flowers of dandelion (*Taraxacum* spp.), *Rosa* spp., and Oregon sunflower (*Balsamorhiza sagittata*).

Distribution. Southern British Columbia; also California and Oregon.

Canadian record. Copper Mountain, B.C.

Comments. Adults of this species are similar to those of *A. retifera* but differ by the uniform green to blue green coloration. Several specimens have been seen that have faint impressions on the elytral disc. These are almost identical to adults of *expansa* except for the distinct green color of *prasina*.

No details of the habits or life history of this species are known.

Genus *Haplanthaxia* Reitter

This genus contains about 8 or 10 species in North America, 7 of which occur in Canada.

This genus is generally included in *Anthaxia* as a subgenus. An assessment of the morphological characters of species in both groups has convinced me that *Haplanthaxia* should be given full generic status.

Description. Body slender, elongate. Head vertical, frons flattened to weakly convex, very shallowly, broadly, longitudinally impressed at middle, surface alveolate-granulate. Epistoma and antennae as in *Anthaxia*. Pronotum as in *Anthaxia*. Elytra elongate; sides distinctly constricted near middle, sides of abdomen visible when viewed from above; surface granulate, glabrous, or with extremely short setae. Ventral surface as in *Anthaxia* except apex of last visible abdominal sternite sometimes notched in females. Legs as in *Anthaxia*.

Comments. The group of species comprising this genus was revised by Cobos (1958) as a subgenus of *Anthaxia*. Barr (1971) and Wellso et al. (1976) also treated some of the species included here in *Anthaxia*. Cobos's (1958) treatment did not adequately describe this group; therefore a complete taxonomic study is needed.

Key to species of *Haplanthaxia* in Canada

1. Tarsal claws with tooth at base 2

Tarsal claws simple, without tooth at base 5

2. Dorsal surface of elytra dark purple black, surface dull; host American plum; probably in southern Ontario .... ***fisheri* (Obenberger)** (p. 152)

Dorsal surface of elytra green, blue, bronze, or combination of these colors, surface usually shining 3

3. Pronotal disc uniformly green or blue, sometimes slightly darkened medially; elytra bluish 4

Pronotal disc bronze or blackish with lateral and/or basal areas greenish; elytra brightly greenish or bluish, usually with large, dark brown or blackish area on each elytron; numerous hosts; Ontario to New Brunswick .... ***quercata* (Fabricius)** (p. 154)

4. Female frons blue; male frons bronze green to blue green; aedeagus with lateral margins of lateral lobes rather strongly arcuate (Fig. 142); host *Carya* spp.; probably in southern Ontario .... ***cyanella* (Gory)** (p. 155)

Female frons with lower half yellow green, reddish purple above; male frons green; aedeagus with lateral margins of lateral lobes weakly arcuate to subparallel (Fig. 143); host *Quercus* spp.; probably in southern Ontario .... ***quercicola* (Wellso)** (p. 156)

5. Elytra dorsally black to dark purple, pronotum frequently with greenish or bronzy areas on lateral margin; Quebec to Manitoba .... ***viridicornis* (Say)** (p. 157)

Body of male dorsally brilliant green to blackish green or purple, female blackish green; southern British Columbia 6

6. Last abdominal segment of female with small notch at apex; males brilliant green .... ***deleta* (LeConte)** (p. 158)

Last abdominal segment of female entire at apex; males less brilliantly green with blackish or purplish tints ..... ***pseudotsugae* (Chamberlin)** (p. 159)

Tableau des espèces d'*Haplanthaxia* du Canada

1. Griffes des tarses avec une dent à la base 2

Griffes des tarses simples, sans dent à la base 5

2. Surface dorsale des élytres violet noir foncé, surface mat; hôte de la prune américaine; probablement dans le sud de l'Ontario .... ***fisheri* Obenberger** (p. 152)

Surface dorsale des élytres verte, bleue, bronzée, ou présentant une combinaison de ces couleurs, surface généralement luisante 3

3. Disque du pronotum uniformément vert ou bleu, parfois un peu plus foncé au milieu; élytres bleuâtres 4

Disque du pronotum bronzé ou noirâtre avec les régions latérales et(ou) basales verdâtres; élytres d'un vert ou bleu brillant, généralement avec une large zone brun foncé ou noirâtre de chaque côté; plusieurs hôtes; Ontario jusqu'au Nouveau-Brunswick .... ***quercata* (Fabricius)** (p. 154)

4. Front chez la femelle bleu; front chez le mâle bronzé vert à bleu-vert; édéage avec les marges latérales des lobes latéraux plutôt fortement arquées (fig. 142); hôte des *Carya* spp.; probablement dans le sud de l'Ontario .... ***cyanella* (Gory)** (p. 155)

Front chez la femelle avec la moitié inférieure jaune vert, la moitié supérieure rougeâtre violet; front chez le mâle vert; édéage avec les marges latérales des lobes latéraux faiblement arquées à subparallèles (fig. 143); hôte des *Quercus* spp.; probablement dans le sud de l'Ontario .... ***quercicola* (Wellso)** (p. 156)

5. Élytres noirs à violet foncé, pronotum souvent avec des zones verdâtres ou bronzées sur la marge latérale; Québec jusqu'au Manitoba .... ***viridicornis* (Say)** (p. 157)

Dessus du corps vert brillant à vert noirâtre ou violet chez le mâle, vert noirâtre chez la femelle; sud de la Colombie-Britannique 6

6. Dernier segment abdominal chez la femelle avec une petite encoche à l'apex; mâles vert brillant .... ***deleta* (LeConte)** (p. 158)

Dernier segment abdominal chez la femelle entier à l'apex; mâles d'un vert moins brillant avec une teinte noirâtre ou violacée .... ***pseudotsugae* (Chamberlin)** (p. 159)

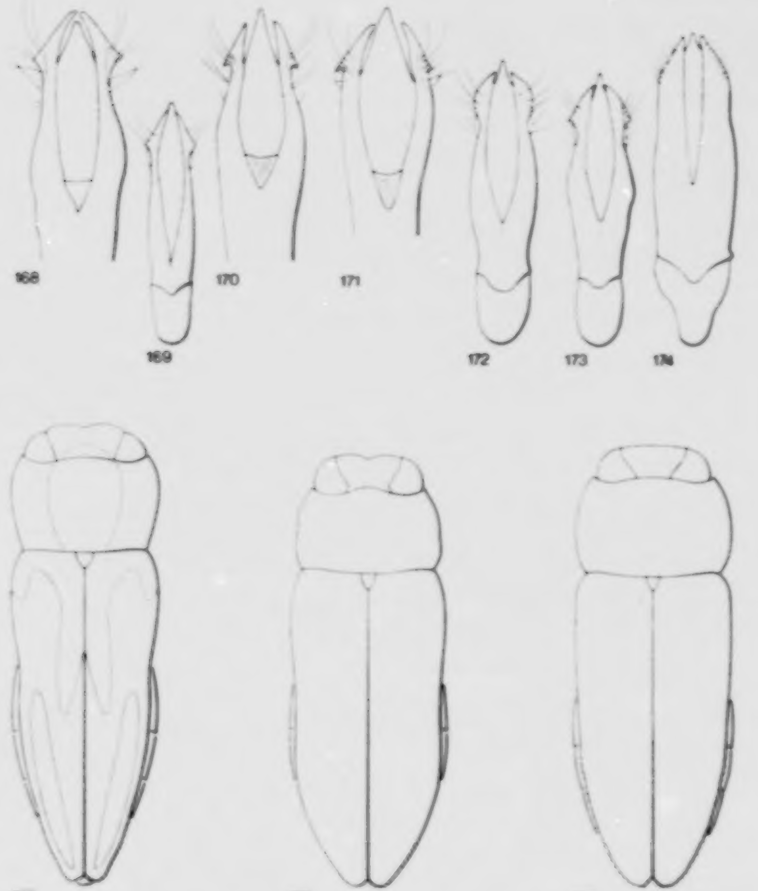
Haplanthaxia fisheri (Obenberger)

Fig. 168

Anthaxia fisheri Obenberger, 1926:247, 255; Cobos 1958:73; Wellso et al. 1976:9.

Description. Body dorsally dark purple black, sometimes with greenish or bronzy tints on lateral margins of pronotum and on elytral base; ventrally purplish black to greenish. Head bright green on frons, black on vertex (♂) or bronzy with greenish yellowish tints (♀); surface distinctly alveolate, alveoli internally minutely reticulate and frequently with very faint median puncture; vestiture inconspicuous. Clypeus narrowly, deeply emarginate, emargination extending about half length of lateral lobes, margins of lateral lobes narrowly rounded. Antennae bluish black to greenish. Pronotum about 1.5 times wider than long, widest in front of middle; sides broadly arcuate on anterior half, subparallel behind; disc with 2 large impressions near posterior angles, transversely convex anteriorly; surface distinctly alveolate, less so at lateral margins, alveoli minutely reticulate internally. Elytra about 2.0 times longer than wide; sides weakly sinuate from humeral angles to

posterior third, then arcuately converging to narrowly rounded apices; surface densely, minutely reticulate. Ventral surface minutely reticulate-punctate, with very short, recumbent setae; last visible abdominal sternite broadly rounded at apex (♂) or feebly notched at apex (♀). Tarsal claws with a basal tooth. Aedeagus as in Fig. 168. Length 4.5-5.3 mm.



Figs. 168-177. 168-173, Aedeagi of *Haplanthaxia* spp. (168, 170-172 redrawn from Wellso et al. 1976; 169, 173 redrawn from Cobos 1958); 168, *H. fisheri*; 169, *H. quercata*; 170, *H. cyanella*; 171, *H. quercicola*; 172, *H. viridicornis*; 173, *H. deleta*; 174, Aedeagus of *Agrilaxia flavimana* (redrawn from Cobos 1958); 175-177, *Haplanthaxia* spp. (redrawn from Cobos 1958); 175, *H. quercata*; 176, *H. viridicornis*; 177, *H. deleta*.

Hosts. Recorded only from American plum (*Prunus americana*).

Distribution. Not recorded from Canada; recorded from Alabama, Kansas, Michigan, Mississippi, and Pennsylvania.

Comments. This is one of the species that Wellso et al. (1976) state occurs in two color forms. Wellso et al. (1976) state that both sexes of *fisheri* are represented by a large, dark purple form and a smaller, bronze green form; they are often collected together on American plum, and have similar aedeagi. Specimens representing both color forms have been seen during this study.

I regard the large, dark purple form as the true *fisheri*, and the smaller, bronze green form as specimens of *quercata*. Specimens of the small, bronze green form have been carefully compared to a number of specimens of *quercata* from several localities and no differences have been found. Cobos (1958) regards *fisheri* as simply a color form of *quercata*.

Adults of *fisheri* are most readily distinguished by the dark purple black color of the elytra and pronotum. Frequently, the lateral margin of the pronotum and the base of the elytra are greenish, greenish yellow, bronzy, or slightly more purplish. The front of the head is bright green in the males and dark purplish, with yellowish green areas laterally near the eyes in the females.

Nothing is known of the biology of this species.

Haplanthaxia quercata (Fabricius)

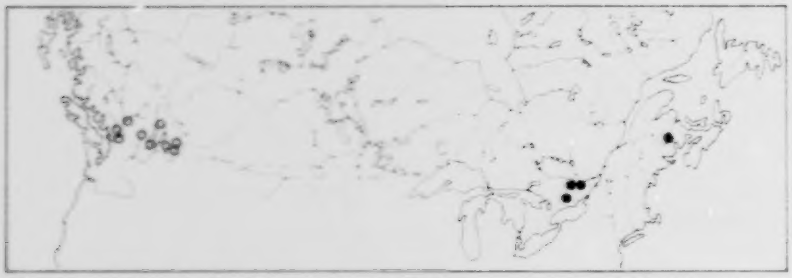
Figs. 169, 175; Map 37

Buprestis quercata Fabricius, 1801:216.

Anthaxia quercata: Chamberlin 1926:90; Craighead 1950:197; Cobos 1958:73; Wellso et al. 1976:9.

Anthaxia cuneiformis Gory, 1841:290.

Description. Body dorsally bicolored or tricolored; pronotal disc bronzy to black in middle, greenish laterally or on base; elytra greenish or bluish, usually with a bronze or blackish longitudinal area behind humeral angles and along sutural and lateral margin; ventrally dark purple to black; legs usually green to blue green. Head uniformly green (♂) or blue green to purple blue with blackish, bronzy, or yellowish green areas (♀); surface distinctly alveolate, alveoli internally minutely reticulate and frequently with fine median puncture; vestiture inconspicuous. Antennae bluish to greenish. Pronotum about 1.4 times wider than long, widest in front of middle; sides moderately arcuate on anterior half, subparallel behind; disc with 2 large, distinct impressions near posterior angles, evenly, transversely convex anteriorly; surface distinctly alveolate, alveoli minutely reticulate internally. Elytra about 2.0 times longer than wide; sides weakly sinuate from humeral angles to posterior third, then arcuately converging to narrowly rounded apices; surface shining, densely, minutely reticulate. Ventral surface minutely reticulate-punctate, with very short, recumbent setae; last visible abdominal



Map 37. Collection localities of *Haplanthaxia quercata* (•) and *H. deleta* (○).

sternite rather narrowly rounded in both sexes, subserrate. Tarsal claws with a basal tooth. Aedeagus as in Fig. 169. Length 3.8–5.3 mm.

Hosts. Recorded from redbud (*Cercis* spp.), hawthorn (*Crataegus* spp.), hickory (*Carya* spp.), American plum (*Prunus americana*), oak (*Quercus* spp.), grape (*Vitis* spp.), tamarack (*Larix laricina*), and pine (*Pinus* spp.). Probably occurs in most species of deciduous trees and in some conifers.

Distribution. Ontario to New Brunswick, south through the eastern and southeastern United States. Also recorded from Montana, but this record is questionable.

Comments. Variations in this species occur mainly in the color pattern. The pronotal disc may be uniformly bronzy or blackish, with two small areas of green near the posterior angles or the green may occupy up to one-third of the width on each side. The elytra may be bluish or greenish, with the dark patch behind the humeral angle varying from a small, longitudinal dash to occupying the entire surface of the elytra, leaving the greenish color only in the scutellum area and along the sutural margin. Many different variations of this color pattern were observed.

The only biological information known about this species is that it breeds in twigs and branches of the host plant.

Haplanthaxia cyanella (Gory)

Fig. 170

Anthaxia cyanella Gory, 1841:285; Chamberlin 1926:90 (as synonym of *quercata*); Cobos 1958:73; Wellso et al. 1976:9.
Anthaxia scoriacea Melsheimer, 1845:143.

Description. Body dorsally with elytra blue; pronotum uniformly green (♂) or blue (♀); ventrally black to purple black. Head uniformly blue (♀) or green (♂); surface distinctly alveolate, alveoli minutely reticulate internally, with distinct, median puncture (♂) or smooth (♀); vestiture inconspicuous. Antennae dark bluish green (♂) to bluish black (♀). Pronotum about 1.6 times wider than long, widest in front of middle; sides moderately arcuate anteriorly, subparallel and weakly converging posteriorly; disc with 2 shallow impressions near posterior angles, evenly, transversely convex anteriorly; surface finely alveolate, alveoli minutely reticulate internally. Elytra about 2.0 times longer than wide; sides weakly sinuate from humeral angles to posterior third, then arcuately converging to narrowly rounded apices; surface irregular, densely, evenly, minutely reticulate. Ventral surface minutely reticulate-punctate, with very short, recumbent setae; last visible abdominal sternite narrowly rounded at apex in both sexes. Tarsal claws with a basal tooth. Aedeagus as in Fig. 170. Length 4.5–5.0 mm.

Hosts. Recorded from hickory (*Carya* spp.); also reared from serviceberry (*Amelanchier arborea*) (Nelson et al. 1981).

Distribution. Not recorded from Canada. It is included here based on Wellso et al.'s (1976) inclusion of this species in their key to Michigan buprestids. The geographical distribution is poorly known.

Comments. Cobos (1958) regards this species as a variety of *quercata*, whereas Wellso et al. (1976) consider it a valid species. Several specimens have been examined and I concur with Wellso.

Adults of *cyanella* can be recognized by the distinctly blue female frons and by the male aedeagus.

Haplanthaxia quercicola (Wellso)

Fig. 171

Anthaxia quercicola Wellso, 1973:165; Wellso et al. 1976:9.

Description. Head green (♂), or lower half of head yellow green with reddish purple band above and bluish purple band at base (♀); pronotum green (♂), or bluish with reddish purple band anteriorly and laterally (♀); elytra purple. Head broadly concave; surface weakly pubescent, with largest punctures in concavity and distinctly reticulate on upper half. Antennae brownish with aqua cast. Pronotum about 1.3 times wider than long, widest behind middle; sides evenly arcuate; disc with broad impression on each side of midline, deepest between middle and basal angle; surface indistinctly reticulate, with minute pores in each reticulation. Elytra about 2.0 times longer than wide; sides weakly sinuate from humeral angle to posterior third, then arcuately converging to narrowly rounded apices; surface granulate except along sutural and lateral margins. Ventral surface as in *quercata* and *cyanella*. Aedeagus as in Fig. 171. Length 3.6 mm.

Hosts. Reared from oak (*Quercus* spp.).

Distribution. Not recorded from Canada but may occur in southern Ontario. Recorded from Texas, Florida, Georgia, Mississippi, and Michigan.

Comments. This species is included because part of the original type material was from Michigan and it is very probable that the species occurs in southern Ontario.

Adults of *quercicola* are likely to be confused with those of *quercata* and *cyanella*. Male specimens of *quercicola* can be separated from those of *quercata* by their smaller size and by the different coloration (see description). Female specimens of *quercicola* can be separated from those of *cyanella* by the entirely blue frons of *cyanella*.

Haplanthaxia viridicornis (Say)

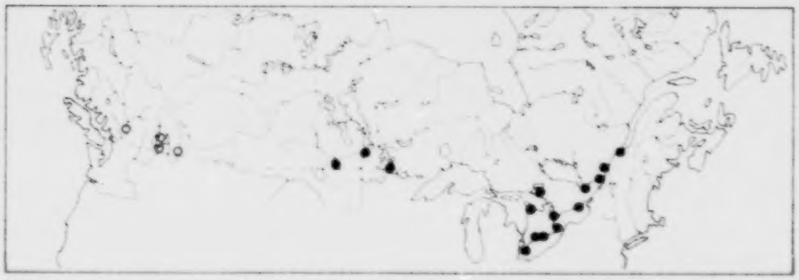
Figs. 172, 176; Map 38

Anthaxia viridicornis Say, 1823:162; Chamberlin 1926:93; Craighead 1950:197; Cobos 1958:79; Wellso et al. 1976:10.

Anthaxia viridifrons Gory, 1841:284; Chamberlin 1926:94; Craighead 1950:197; Cobos 1958:79; Wellso et al. 1976:10.

Anthaxia subaenea LeConte, 1860:216.

Description. Head bright green, bronzy green, or bright blue green (♂) or dark purplish bronze or blackish bronze (♀), frequently with bronzy reflections along epistoma in both sexes; pronotum dark bronze or, less frequently, purplish bronze, with lateral margins bright bronzy green or occasionally bronzy red (♂) or evenly bronze with lateral margins sometimes darker bronze, black, blue black, or purplish black in both sexes; ventrally greenish blue to black. Head with surface distinctly alveolate, alveoli internally smooth (♂) or minutely reticulate (♀), sometimes with faint median puncture; vestiture inconspicuous. Antennae green (♂) or piceous (♀). Pronotum about 1.4 to 1.6 times wider than long, widest in front of middle; sides moderately arcuate anteriorly, subparallel behind; disc with pair of shallow, median impressions and pair of deeper, larger impressions at posterior angles; surface distinctly alveolate, alveoli reticulate internally on both sexes. Elytra about 1.8 times longer than wide; sides weakly constricted on anterior half, then



Map 38. Collection localities of *Haplanthaxia viridicornis* (•) and *H. pseudotsugae* (○).

slightly expanded, then arcuately converging to narrowly rounded apices; surface shining, densely minutely reticulate, with fine lines and punctures. Ventral surface minutely reticulate, punctate, with short, recumbent setae; last visible abdominal sternite narrowly rounded in both sexes. Tarsal claws simple, swollen at base. Aedeagus as in Fig. 172. Length 4.0–5.5 mm.

Hosts. Bred from shagbark hickory (*Carya ovata*), oak (*Quercus* spp.), and American elm (*Ulmus americana*). Reported from willow (*Salix* spp.) and grape (*Vitis* spp.).

Distribution. Quebec to Manitoba, south through tne eastern and midwestern United States to Texas in the south and Colorado in the west.

Comments. This species is extremely variable in color, which has led to the establishment of a number of races and varieties. The most noteworthy of these is the variety *viridifrons* Gory, which several authors recognize as a distinct species. Cobos (1958) placed *viridifrons* in synonymy under *viridicornis*; most recently, Wellso et al. (1976) have retained *viridifrons* as a species. I have examined specimens of both "forms" and cannot detect any meaningful differences in the shape or structure of the male aedeagus nor can I see any external distinctions between the specimens other than color. The pronotum of "typical" male *viridifrons* is bronzy medially, with the lateral margins greenish, more broadly pigmented anteriorly, whereas in the "typical" male *viridicornis*, the lateral color extends farther onto the disc, as much as one-quarter of the width of the pronotum. The extremes of this color difference are obvious, but numerous specimens have been examined that intergrade completely and fill in any preceived gaps. I have therefore followed Cobos (1958) and regard *viridifrons* as a synonym of *viridicornis*.

Chamberlin (1926) and Cobos (1958) both include British Columbia in the distribution of this species, presumably based on a report by Gibson (1917). The specimens Gibson examined are in the Canadian National Collection and have been reexamined during the preparation of this book. The specimens are all dark-colored females of *deleta*, easily recognizable by the small notch on the apex of the last visible abdominal segment.

The coloration of the adults of this species is variable. The extremes of the coloration is mentioned in the foregoing description, but it must be realized that not all the possible color combinations can be mentioned. The eastern distribution, the entire margin of the last visible abdominal segment of the female, and the shape of the male aedeagus distinguish this species from other Canadian representatives of the genus.

Haplanthaxia deleta (LeConte)

Figs. 37, 173, 177; Map 37

Anthaxia deleta LeConte, 1878:459; Chamberlin 1926:89; Cobos 1958:76; Barr 1971:67.

Description. Head, pronotum, elytra, legs, and ventral surface brilliant green (♂) or very dark blackish green (♀). Head more or less evenly convex, very weakly longitudinally impressed in middle; surface distinctly alveolate, alveoli internally reticulate, some with an internal granule; vestiture inconspicuous. Antennae green (♂) or blackish green (♀). Pronotum about 1.4–1.5 times wider than long, widest in front of middle; sides arcuate, more strongly so posteriorly; disc convex, weakly impressed at apical angles, sometimes weakly flattened in middle; surface finely alveolate, alveoli internally very densely and minutely reticulate, devoid of internal granules. Elytra about 1.8 times longer than wide; sides weakly constricted at middle, then slightly expanded and arcuately converging to narrowly rounded apices; surface moderately shining, densely minutely reticulate. Ventral surface finely punctured; last visible abdominal sternite broadly rounded at apex (♂) or with a small but distinct notch at apex (♀). Tarsal claws simple, swollen at base. Aedeagus as in Fig. 173. Length 4.0–6.0 mm.

Hosts. Taken on willow (*Salix* spp.), water birch (*Betula occidentalis*), dogwood (*Cornus* spp.), and alder (*Alnus* spp.). The adults are frequently taken in flowers of redroot (*Ceanothus* spp.).

Distribution. Southern British Columbia, south through the western United States.

Comments. Adults of this species are easily distinguished by the brilliant green color of the male, by the blackish green color of the female, by the small notch at the apex of the last visible abdominal sternite of the female, and by the western distribution. *Haplanthaxia deleta* can only be confused with *pseudotsugae*, but the characters given in the key separate the species.

Haplanthaxia pseudotsugae (Chamberlin)

Map 38

Anthaxia pseudotsugae Chamberlin, 1928:95; Cobos 1958:76; Barr 1971:67.

Description. Similar to *deleta* but differs by the darker green color of males and by the broadly rounded apex of the last visible abdominal sternite of both sexes. Length 4.0–6.0 mm.

Hosts. Reared from branches of Douglas-fir (*Pseudotsuga menziesii*) in California.

Distribution. Southern British Columbia to California

Comments. The identity of this species is somewhat questionable. I have distinguished this species from *deleta* by the presence, in the female of *deleta*, of a small notch at the apex of the last visible abdominal sternite; the female of *pseudotsugae* has no such notch. However, in the original description of *pseudotsugae*, Chamberlin (1928) states that the last ventral segment of the female has a small, semicircular emargination, and that of the male is entire. There is a series of 10 specimens in the Canadian National

Collection from California reared from branches of Douglas-fir. The specimens in this series have been identified as *pseudotsugae* by H. B. Leech; however, the margin of the last ventral segment is entire in the female, not notched. In all the specimens currently placed under *deleta* in the Canadian National Collection the last ventral segment of female abdomen is notched.

Until types of the various species can be examined, I am regarding specimens that have been obtained from Douglas-fir (and possibly other conifers), and that have an entire margin of the last ventral segment of both sexes, as *pseudotsugae*. Obviously, a generic revision of this genus and *Anthaxia* is definitely required.

Genus *Agrilaxia* Kerremans

This genus contains one species in North America (Cobos 1971).

Members of this genus may be easily confused with species in *Agrilus*, based on general appearance. The anterior margin of the hind coxal plate in *Agrilus* is rather deeply emarginate, whereas in *Agrilaxia* this margin is nearly straight.

The species are of no known economic importance.

Description. Head vertical, convex, not impressed in middle, surface alveolate. Clypeus weakly emarginate, otherwise as in *Anthaxia*. Antennae and eyes as in *Anthaxia*. Pronotum wider than long, widest on anterior half; anterior margin weakly sinuate; base straight, transverse. Scutellum as in *Anthaxia*. Elytra elongate, very narrow, base slightly sinuate; sides strongly converging on posterior half, abdomen broadly exposed; surface granulose, with very short setae. Ventral surface finely punctured; prosternal process as in *Anthaxia*. Legs as in *Anthaxia*.

Comments. This genus seems to be related to *Haplanthaxia* but differs by the more elongate body form and by the strongly convex, not impressed head.

Agrilaxia flavimana (Gory)

Figs. 174, 178

Anthaxia flavimana Gory, 1841:291.

Anthaxia (*Agrilaxia*) *flavimana*: Cobos 1971:48.

Agrilaxia flavimana: Knull 1925:27; Chamberlin 1926:45; Craighead 1950:197; Wellso et al. 1976:11.

Description. Head green or blue green, sometimes black on vertex (♂) or completely black (♀), pronotum black in median area, blue, green, or blue green on lateral portions (♂) or entirely black (♀); elytra black with bluish, bronzy, or dark coppery tints in both sexes. Head strongly convex; surface with alveoli distinct, internally reticulate (♀) or minutely punctured (♂); vestiture inconspicuous. Antennae blackish green (♂) or black (♀). Pronotum

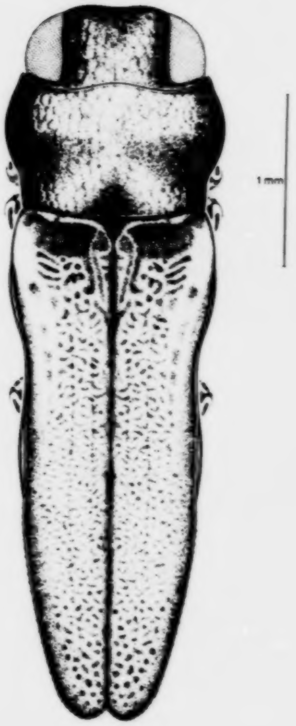


Fig. 178. *Agrilaxia flavimana.*

1.3–1.4 times wider than long, widest anteriorly; sides broadly rounded on anterior third, straight and converging behind; disc with pair of distinct impressions on basal half near lateral margin and smaller, deeper impression just before scutellum; surface densely, minutely reticulate, alveoli walls weakly raised, indistinct, more distinct in female. Elytra about 3.0 times longer than wide; sides weakly constricted on anterior half, slightly expanded in middle, then converging to narrowly rounded apices; surface very densely reticulate-granulate, with uneven punctures forming obscure, irregular rows. Ventral surface finely punctured; last visible abdominal sternite narrowly rounded, strongly serrate at apex in both sexes. Aedeagus as in Fig. 174. Length 3.8–5.0 mm.

Hosts. Taken on oak (*Quercus* spp.) and plum (*Prunus* spp.).

Distribution. Southern Ontario, south to Texas and Florida.

Canadian record. Point Pelee, Ont.

Comments. Adults of this species are easily recognized by the characters given in the key to genera and in the specific and generic descriptions.

Nothing is known of the habits or life history of this species, except that it breeds in small branches of its host plants (Baker 1972).

Genus *Chrysobothris* Eschscholtz

This large genus contains about 115 species in North America, of which 34 occur or may occur in Canada. Several of these species are economically important to the forest industry in North America.

Many of the species are similar in appearance and the task of identifying them is by no means a simple one. The best characters to identify species or to check individual specimens are on the aedeagi. These characters, however, are difficult to use; therefore the key to species has been designed to avoid them unless absolutely necessary. Complete illustrations of the aedeagi can be found in Fisher (1942) and the reader is referred there for more information.

The larvae of *Chrysobothris* species are found in both coniferous and deciduous trees, as well as in shrubs and herbaceous plants. The general characteristics of the larvae are given in Benoit (1964). Some species are found only in conifers, some only in deciduous trees, whereas others attack both. Plants of all ages may be attacked, and any part of the plant from the roots to the twigs are subject to infestation. However, the bark and wood of the main trunk are most commonly infected, the larvae causing "worm holes" and thus making lumber from infested trees unfit for high-grade use. Some species are particularly troublesome to recently transplanted orchard and shade trees.

Description. Head vertical, frons even or uneven, much wider at clypeal area than at vertex, and narrowed by insertion of antennae; clypeus broad, more or less sinuate or emarginate in front and constricted posteriorly by the antennal cavities. Antennae (Fig. 38) variable, sometimes bipectinate in the males. Eyes very large, elongate, strongly oblique on inner margins, closer on the vertex than below. Pronotum usually wider than long, variable in shape, base bisinuate and usually lobed medially. Scutellum small, triangular, rarely long and acuminate at apex. Elytra about 2.0 times longer than wide, rounded or angulate at bases; sides strongly converging posteriorly, serrate or entire toward apices. Prosternum broad, flat or convex, anterior margin frequently with a median lobe. Legs robust; femora swollen at middle, anterior pair usually armed with a large tooth; tarsus compressed, first segment of metatarsus long, third segment slightly emarginate, without long spines at apex; tarsal claws simple.

Comments. Fisher (1942) revised this genus and Barr (1971) treated the northwestern species.

Key to species of *Chrysobothris* in Canada and Alaska

1. Elytra pubescent, hairs more or less conspicuous 2

Elytra glabrous except sometimes pubescent on lateral margins 6

2. Pronotum convex, without median depression; each elytron with 1 or 2 somewhat indistinct longitudinal costae or costae absent; last visible abdominal sternite of male deeply, arcuately emarginate at apex, that of female broadly rounded or slightly notched at apex; on *Fragaria* spp.; Washington, Idaho, and Oregon .... ***fragariae*** **Fisher** (in part) (p. 171)

Pronotum flattened, or with distinct median depression 3

3. Dorsal surface of body with distinct pubescence 4

Dorsal surface of body with indistinct pubescence 5

4. Each elytron with 4 more or less distinct, longitudinal costae; dilation on anterior tibiae of male obtusely angulated at apex; on *Geranium* spp.; southern British Columbia .... ***oregona*** **Chamberlin** (p. 173)

Each elytron with 1 or 2 indistinct, longitudinal costae; dilation on anterior tibiae of male broadly rounded at apex; on *Fragariae* spp.; Washington, Idaho, and Oregon .... ***fragariae*** **Fisher** (in part) (p. 171)

5. Lateral margins of elytra distinctly serrate posteriorly; each elytron with first costa strongly elevated posteriorly and with 1-3 pairs of small, densely punctured, usually reddish foveae; on deciduous trees and shrubs; southern British Columbia .... ***mali*** **Horn** (in part) (p. 174)

Lateral margins of elytra less distinctly serrate posteriorly; each elytron with first costa weakly elevated posteriorly and with 2 or 3 pairs of large, shallow, greenish foveae; hosts unknown; Alberta and Saskatchewan .... ***aeneola*** **LeConte** (p. 176)

6. Lateral margins of last visible abdominal sternite not serrate 7

Lateral margins of last visible abdominal sternite serrate 9

7. Elytra with more or less distinct, longitudinal costae 8

Elytra without a trace of longitudinal costae; on oak; Michigan .... ***chlorocephala*** **Gory** (p. 177)

8. Body dorsally dark bronzy brown or black, with 3 reddish foveae on each elytron; Ontario, Quebec .... ***sexsignata*** **(Say)** (p. 178)

Body dorsally purplish to blue black, with foveae usually greenish or bluish; southern British Columbia, Saskatchewan, and Ontario .... ***azurea*** **LeConte** (p. 180)

9. Abdominal sternites brassy green to bright green or bright blue with or without reddish or coppery reflections laterally 10

Abdominal sternites blackish, brownish, purplish, or coppery, sometimes brassy with greenish luster 14

10. Body dorsally bright green or frequently bluish, sometimes lateral margin of pronotum reddish coppery; on pine; transcontinental .... ***harrisi*** **(Hentz)** (p. 181)

Body dorsally blackish or brownish, occasionally with intervening bluish or greenish markings on elytra 11

11. Prosternum densely pubescent 12

Prosternum glabrous or sparsely pubescent 13

12. Abdomen bright green; elytra with densely punctured areas usually green; on Douglas-fir; southern British Columbia .... ***sylvania*** **Fall** (p. 182)

Abdomen green with brassy luster; on larch, pine, Douglas-fir; southern British Columbia .... ***laricis*** **Van Dyke** (p. 183)

13. Punctured areas on elytra coppery to black, callosities usually small and numerous, elytral apices coppery; frons of male greenish gold; on Douglas-fir; southern British Columbia .. ***carinipennis* LeConte** (in part) (p. 184)

Punctured areas on elytra brassy to green, usually with 3 pairs of large, irregular callosities, elytral apices not coppery; frons of male green; on Douglas-fir, possibly on other conifers; southern British Columbia .... ***pseudotsugae* Van Dyke** (in part) (p. 186)

14. Clypeus transversely truncate, or at most only sinuate in front; on pine; Alberta to Quebec .... ***cribraria* Mannerheim** (p. 187)

Clypeus emarginate, or with median incision in front 15

15. Anterior tibiae of male bearing several small teeth on inner margin; eighth abdominal tergite of female longitudinally carinate ...(*femorata* complex) 16

Anterior tibiae of male bearing a single tooth or dilation on inner margin; eighth abdominal tergite of female not longitudinally carinate 20

16. Clypeus acutely notched at middle, more angulately rounded on each side; on hickory; eastern .... ***adelpha* Gemminger & Harold** (p. 188)

Clypeus acutely notched at middle, semicircularly rounded on each side 17

17. Aedeagus as in Fig. 192; on American plum; Michigan .... ***sloicola* Manley & Wellso** (p. 189)

Aedeagus as in Figs. 193–195; hosts varied but not on American plum 18

18. Antennae gradually narrowed to apex, last segment not distinctly transverse and narrower than 10th segment; median carina on eighth abdominal tergite of female not strongly elevated, not extending beyond apical notch 19

Antennae not narrowed to apex, last segment transverse and as wide as 10th segment; median carina on eighth abdominal tergite of female strongly elevated, extending beyond apical notch; on chestnut and oak; Manitoba to Quebec .... ***rugosiceps* Melsheimer** (p. 189)

19. Antennal segments of male distinctly pale yellow toward outer margins; elytral disc and apex unicolored; posterior pair of foveae separated by longitudinal costa; on deciduous trees; eastern .... ***viridiceps* Melsheimer** (p. 190)

Antennal segments of male entirely bronzy green, usually becoming reddish coppery toward antennal apex; elytral disc and apex bicolored; posterior pair of foveae usually confluent, bisecting costa interrupted; on deciduous trees; transcontinental .... ***femorata* (Olivier)** (in part) (p. 190)

20. Clypeus acutely incised at middle, with tooth on side of incision; on pine; Washington to California .... ***semisculpta* LeConte** (p. 194)

Clypeus broadly, triangularly, or acutely emarginate in front 21

21. Elytra uniformly green, bluish green or purple; on conifers; Alberta to Nova Scotia .... ***verdigripennis* Frost** (in part) (p. 195)

Elytra black, brown, coppery, or bronzy brown 22

22. Pronotum more or less uniform, occasionally with longitudinal impressions at middle, callosities, when present, small, not extending entire length, not present near sides 23

Pronotum irregular, uneven, usually with median and lateral impressions and conspicuous callosities on each side of middle and near sides **or** surface transversely rugose 27

23. Lateral portions of last visible abdominal sternite strongly asperate; anterior tibia of male with several small teeth on inner margin; clypeus semicircularly rounded on each side of small notch; on deciduous trees; transcontinental .... ***femorata* (Olivier)** (in part) (p. 190)

Lateral portions of last visible abdominal sternite at most weakly asperate; anterior tibia of male devoid of small teeth on inner margin; clypeus broadly emarginate; on conifers 24

24. Occurring from Manitoba eastward 25

Occurring in southern British Columbia 26

25. Head and antennae of male bronzy brown; last visible abdominal sternite of female rounded or shallowly emarginate at apex; Manitoba to Quebec .. .. *pusilla* **Gory & Laporte** (p. 196)

Head and antennae of male, in part, bright green; last visible abdominal sternite of female deeply, arcuately emarginate at apex; Manitoba to Nova Scotia .... ***neopusilla*** **Fisher** (p. 198)

26. Clypeus usually shallowly and broadly emarginate in front; frons brassy or greenish; protibia of male strongly notched before subapical dilation; on cupressine trees .... ***nixa*** **Horn** (p. 199)

Clypeus rather deeply and broadly emarginate in front; frons usually coppery (♀), or greenish (♂); protibia of male not notched; on deciduous trees and shrubs .... ***mali*** **Horn** (in part) (p. 174)

27. Antennal segments 4–11 in part distinctly yellowish 28

Antennal segments 4–11 not distinctly yellowish, but sometimes more or less pale piceous 29

28. Anterior tibia of male with large emarginated dilation at apex; dorsal surface of body of both sexes frequently greenish; on conifers; Alberta to Nova Scotia .... ***verdigripennis*** **Frost** (in part) (p. 195)

Anterior tibia of male with small, slightly emarginated dilation at apex; dorsal surface of body of both sexes never greenish; on pine and larch; transcontinental .... ***dentipes*** **(Germar)** (p. 200)

29. Pronotum transversely rugose at middle, not longitudinally sulcate, but with 1 or 2 arcuate impressions on each side of middle; on conifers; Washington to California .... ***dolata*** **Horn** (p. 201)

Pronotum longitudinally (sometimes vaguely) sulcate at middle 30

30. Prosternum with distinct median lobe on anterior margin 31

Prosternum without median lobe on anterior margin or lobe very weakly indicated 36

31. Clypeus shallowly emarginate in front 32

Clypeus deeply emarginate in front 33

32. Pronotum with distinct, irregular, smooth, elevated callosities; large species, 11–17 mm; on pine; southern British Columbia .. ***grandis*** **Chamberlin** (p. 202)

Pronotum without distinct, smooth, elevated callosities; small species, 7–9 mm; on eastern red cedar; Michigan .... ***neotexana*** **Dozier** (p. 203)

33. Pronotum without distinct, irregular, smooth callosities; on deciduous trees and shrubs; southern British Columbia .... ***mali*** **Horn** (in part) (p. 174)

Pronotum with distinct, irregular, elevated, smooth callosities 34

34. Dilation on anterior tibia of male not narrowed at apex or only slightly so; last visible abdominal sternite of female shallowly emarginate at apex, not limited beneath by thin plate .... ***trinervia*** **(Kirby)** (in part) (p. 212)

Dilation on anterior tibia of male distinctly narrowed at apex; last visible abdominal sternite of female deeply emarginate, or limited beneath by thin, projecting plate 35

35. Dilation on anterior tibia of male gradually narrowed at apex; last visible abdominal sternite of female deeply, narrowly notched at apex; on larch and pine; Saskatchewan to New Brunswick .... ***blanchardi*** **Horn** (p. 203)

Dilation on anterior tibia of male abruptly narrowed at apex; last visible abdominal sternite of female with emargination at apex limited at bottom by thin, slightly projecting deflexed plate; on pine; southern British Columbia (see also *caurina*, p. 000) .... ***leechi*** **Barr** (p. 205)

36. Body size large, 14–17 mm long 37

Body size smaller, 6–13 mm long 39

37. Eastern species (Manitoba to Quebec) .... ***orono*** **Frost** (p. 206)

Western species (southern British Columbia and Alberta) 38

38. Ventral surface of abdomen brassy with a greenish luster; protibia of male with a weakly developed dilation; on pine .... ***columbiana*** **Barr** (p. 207)

Ventral surface of abdomen purple; protibia of male with a notch before the sinuate subapical dilation; hosts unknown .. ***vulcanica*** **LeConte** (p. 208)

39. Ventral surface of abdomen brownish, purplish, or coppery, sometimes with faint greenish reflections or bronzy tinge 40

Ventral surface of abdomen bright green to bronzy green except in females of *sylvania* and *laricis*, which have the venter more or less purplish coppery, with distinct bronzy green tinge 43

40. Posterior tibia of male arcuate; last visible abdominal sternite of female broadly, arcuately emarginate at apex .... ***scabripennis*** **Gory & Laporte** (p. 209)

Posterior tibia of male straight; last visible abdominal sternite of female with small semicircular or triangular emargination at apex, if broadly emarginate then emargination limited at bottom by deflexed plate 41

41. Dilation on anterior tibia of male abruptly narrowed at apex; last visible abdominal sternite of female with the emargination at apex limited at bottom by a thin plate, anterior margin of plate truncate or sinuate; on pine; southern British Columbia (see also *leechi*, p. 205) .... ***caurina*** **Horn** (p. 211)

Dilation on anterior tibia of male not narrowed at apex, or only slightly so; last visible abdominal sternite of female with the emargination at apex not limited at bottom by thin plate 42

42. Median lobe of aedeagus acute or narrowly rounded at apex (Fig. 208); last visible abdominal sternite of female with small, semicircular emargination at apex; on conifers; transcontinental .... ***trinervia*** **(Kirby)** (p. 212)

Median lobe of aedeagus truncate at apex (Fig. 209); last visible abdominal sternite of female with very small, triangular notch at apex; on conifers; Alberta(?) and British Columbia(?) .... ***breviloba*** **Fall** (p. 214)

43. Prosternum of male densely pubescent; female with abdomen purplish or coppery, not greenish at middle 44

Prosternum of male sparsely pubescent; female with abdomen greenish at middle; becoming purplish coppery laterally 46

44. Discal and sutural elytral costae forming a "Y" near elytral apex; lateral lobes of aedeagus short and blunt (Fig. 182); last visible abdominal sternite of female subtruncate and often with small, angulate lobe at middle .... ***beeri*** **Barr** (p. 215)

Discal and sutural elytral costae not forming a "Y" near elytral apex; lateral lobes of aedeagus more elongate, acute at apex (Figs. 158, 159); last visible sternite of female deeply emarginate at apex 45

45. Dilation on anterior tibia of male abruptly narrowed at apex, tibia strongly constricted behind dilation .... ***laricis*** **Van Dyke** (in part) (p. 183)

Dilation on anterior tibia of male not abruptly narrowed at apex, tibia slightly constricted behind dilation .... ***sylvania*** **Fall** (in part) (p. 182)

46. Elytra with punctured areas coppery to blackish, callosities usually small and numerous, elytral apices coppery; frons of male greenish gold; on conifers; southern British Columbia ...... ***carinipennis*** **LeConte** (in part) (p. 184)

Elytra with punctured areas brassy to green, usually with 3 pairs of large, irregular callosities, elytral apices not coppery; frons of male green; on conifers; southern British Columbia .... *pseudotsugae* **Van Dyke** (in part) (p. 186)

Tableau des espèces de *Chrysobothris* du Canada et de l'Alaska

1. Élytres pubescents, les soies plus ou moins apparentes 2
Élytres glabres, sauf parfois pubescents sur les marges latérales 6
2. Pronotum convexe, sans dépression médiane; chaque élytre avec une ou deux costae longitudinales peu distinctes ou sans costae; dernier sternite abdominal visible du mâle profondément échancré à l'apex, celui de la femelle arrondi ou légèrement échancré à l'apex; sur les *Fragaria* sp.; Washington, Idaho et Oregon .... *fragariae* **Fisher** (en partie) (p. 171)
Pronotum aplati, ou avec une dépression médiane distincte 3
3. Surface dorsale du corps avec pubescence distincte 4
Surface dorsale du corps avec pubescence peu distincte 5
4. Chaque élytre avec 4 costae longitudinales plus ou moins distinctes; dilatation sur les tibias antérieurs du mâle formant un angle obtus à l'apex; sur les *Geranium* sp.; sud de la Colombie-Britannique .... *oregona* **Chamberlin** (p. 173)
Chaque élytre avec une ou deux costae longitudinales indistinctes; dilatation sur les tibias antérieurs du mâle largement arrondie à l'apex; sur les *Fragariae* sp.; Washington, Idaho et Oregon .. *fragariae* **Fisher** (en partie) (p. 171)
5. Marges latérales des élytres distinctement dentelées postérieurement; chaque élytre avec la première costa fortement soulevée postérieurement et avec 1-3 paires de petites fossettes, généralement rougeâtres, très ponctuées; sur les décidus et les arbustes; sud de la Colombie-Britannique .... *mali* **Horn** (en partie) (p. 174)
Marges latérales des élytres moins distinctement dentelées postérieurement; chaque élytre avec la première costa faiblement soulevée postérieurement et avec 2 ou 3 paires de fossettes verdâtres, larges et peu profondes; hôtes inconnus; Alberta et Saskatchewan .... *aeneola* **LeConte** (p. 176)
6. Marges latérales du dernier sternite abdominal visible non dentelées 7
Marges latérales du dernier sternite abdominal visible dentelées 9
7. Élytres avec des costae longitudinales plus ou moins distinctes 8
Élytres sans trace de costae longitudinales; sur le chêne; Michigan .... *chlorocephala* **Gory** (p. 177)
8. Surface dorsale du corps d'un brun bronzé foncé ou noir, avec 3 fossettes rougeâtres sur chaque élytre; Ontario, Québec .... *sexsignata* **(Say)** (p. 178)
Surface dorsale du corps violacée à bleu-noir, avec les fossettes généralement verdâtres ou bleuâtres; sud de la Colombie-Britannique, Saskatchewan et Ontario .... *azurea* **LeConte** (p. 180)
9. Sternites abdominaux vert cuivré jaune à vert brillant ou bleu brillant, avec ou sans reflets rougeâtres ou cuivrés latéralement 10
Sternites abdominaux noirâtres, brunâtres, violacés, ou cuivrés, parfois cuivré jaune avec un lustre verdâtre 14
10. Surface dorsale du corps vert brillant ou souvent bleuâtre, parfois avec les marges latérales du pronotum rougeâtre cuivré; sur le pin; transcontinental .... *harrisi* **(Hentz)** (p. 181)

Surface dorsale du corps noirâtre ou brunâtre, parfois avec des taches bleuâtres ou verdâtres sur les élytres 11

11. Prosternum avec une pubescence dense 12

Prosternum glabre ou avec une pubescence éparse 13

12. Abdomen vert brillant; élytres avec les zones très ponctuées généralement vertes; sur le sapin de Douglas; sud de la Colombie-Britannique .... ***sylvania* Fall** (p. 182)

Abdomen vert avec un lustre cuivré jaune; sur le mélèze, le pin, le sapin de Douglas; sud de la Colombie-Britannique .... ***laricis* Van Dyke** (p. 183)

13. Zones ponctuées sur les élytres cuivrées à noires, les callosités généralement petites et nombreuses, apex des élytres cuivré; front du mâle doré verdâtre; sur le sapin de Douglas; sud de la Colombie-Britannique .... ***carinipennis* LeConte** (en partie) (p. 184)

Zones ponctuées sur les élytres cuivré jaune à vertes, généralement avec 3 paires de larges callosités irrégulières, apex des élytres non cuivré; front du mâle vert; sur le sapin de Douglas, possiblement sur d'autres conifères; sud de la Colombie-Britannique ..... ***pseudotsugae* Van Dyke** (en partie) (p. 186)

14. Clypéus tronqué, ou au plus seulement sinueux antérieurement; sur le pin; Alberta jusqu'au Québec .... ***cribraria* Mannerheim** (p. 187)

Clypéus échancré, ou avec une incision médiane antérieurement 15

15. Tibias antérieurs du mâle avec plusieurs petites dents sur la marge interne; huitième tergite abdominal chez la femelle caréné longitudinalement .... (*femorata* complex) 16

Tibias antérieurs du mâle avec une dent ou dilatation sur la marge interne; huitième tergite abdominal chez la femelle sans carène longitudinale ... 20

16. Clypéus avec entaille aigue au milieu, arrondi de manière plus angulaire de chaque côté; sur l'hickory; espèce de l'Est .... ***adelpha* Gemminger & Harold** (p. 188)

Clypéus avec entaille aigue au milieu, arrondi de manière semi-circulaire de chaque côté 17

17. Édéage comme sur la fig. 192; sur le *Prunus americana*; Michigan .... ***sloicola* Manley & Wellso** (p. 189)

Édéages comme sur les fig. 193-195; plusieurs hôtes mais pas sur le *Prunus americana* 18

18. Antennes graduellement rétrécies à l'apex, dernier article non distinctement transverse et plus étroit que le dixième article; carène médiane sur le huitième tergite abdominal chez la femelle non fortement soulevée, ne dépassant pas l'entaille apicale 19

Antennes non rétrécies à l'apex, dernier article transverse et aussi large que le dixième article; carène médiane sur le huitième tergite abdominal chez la femelle fortement soulevée, dépassant l'entaille apicale; sur le châtaigne et le chêne; Manitoba jusqu'au Québec ... ***rugosiceps* Melsheimer** (p. 189)

19. Articles antennaires du mâle distinctement jaune pâle vers les marges externes; disque et apex des élytres unicolores; la paire postérieure des fossettes séparée par une costa longitudinale sur les décidues; espèce de l'Est .... ***viridiceps* Melsheimer** (p. 190)

Articles antennaires du mâle entièrement vert bronzé, le plus souvent devenant rougeâtre cuivré vers l'apex de l'antenne; disque et apex des élytres bicolores; la paire postérieure de fossettes généralement confondues, la costa bissectrice interrompue; sur les décidues; transcontinental .... ***femorata* (Olivier)** (en partie) (p. 190)

20. Clypéus avec incision aigue au milieu, avec une dent sur le côté de l'incision; sur le pin; Washington à Californie ...... ***semiscalpta* LeConte** (p. 194)

Clypéus largement, triangulairement, ou profondément échancré en avant 21

21. Élytres uniformément verts, vert bleuâtre ou violets; sur les conifères; Alberta jusqu'à la Nouvelle-Écosse ..... ***verdigripennis* Frost** (en partie) (p. 195)
Élytres noirs, bruns, cuivrés, ou brun bronzé 22

22. Pronotum plus ou moins uniforme, parfois avec des impressions longitudinales au milieu, callosités (si présentes) petites, ne s'étendant pas sur toute la longueur, absentes vers les côtés 23
Pronotum irrégulier, généralement avec des impressions médianes et latérales et des callosités distinctes de chaque côté du milieu et vers les côtés, ou surface transversalement rugueuse 27

23. Parties latérales du dernier sternite abdominal visible très rugueuses; tibia antérieur du mâle avec plusieurs petites dents sur la marge interne; clypéus arrondi de façon semicirculaire sur chaque côté de la petite entaille; sur les décidus; transcontinental .... ***femorata* (Olivier)** (en partie) (p. 190)
Parties latérales du dernier sternite abdominal visible au plus faiblement rugueuses; tibia antérieur du mâle sans petites dents sur la marge interne; clypéus largement échancré; sur les conifères 24

24. Espèces se rencontrant à l'est de la Saskatchewan 25
Espèces se rencontrant dans le sud de la Colombie-Britannique 26

25. Tête et antennes du mâle brun bronzé; dernier sternite abdominal visible de la femelle arrondi ou légèrement échancré; Manitoba jusqu'au Québec .... ***pusilla* Gory & Laporte** (p. 196)
Tête et antennes du mâle en partie vert brillant; dernier sternite abdominal visible de la femelle profondément échancré à l'apex; Manitoba jusqu'à la Nouvelle-Écosse .... ***neopusilla* Fisher** (p. 198)

26. Clypéus en général légèrement et largement échancré en avant; front cuivré ou verdâtre; protibia du mâle fortement échancré avant la dilatation subapicale; sur les cupressacées .... ***nixa* Horn** (p. 199)
Clypéus plutôt profondément échancré en avant; front généralement cuivré (♀), ou verdâtre(♂); protibia du mâle non échancré; sur les décidus et les arbustes .... ***mali* Horn** (en partie) (p. 174)

27. Articles antennaires 4-11 en partie distinctement jaunâtres 28
Articles antennaires 4-11 non distinctement jaunâtres, mais parfois plus ou moins noir rougeâtre pâle 29

28. Tibia antérieur du mâle avec une large dilatation échancrée à l'apex; surface dorsale du corps, chez les deux sexes, souvent verdâtre; sur les conifères; Alberta jusqu'à la Nouvelle-Écosse .. ***verdigripennis* Frost** (en partie) (p. 195)
Tibia antérieur du mâle avec une petite dilatation légèrement échancrée à l'apex; surface dorsale du corps, chez les deux sexes, jamais verdâtre; sur le pin et le mélèze; transcontinental .... ***dentipes* (Germar)** (p. 200)

29. Pronotum transversalement rugueux au milieu, sans sillon longitudinal, mais avec 1 ou 2 impressions de chaque côté du milieu; sur les conifères; Washington jusqu'à la Californie .... ***dolata* Horn** (p. 201)
Pronotum avec un sillon longitudinal (parfois vague) au milieu 30

30. Prosternum avec un lobe médian distinct sur la marge antérieure 31
Prosternum sans lobe avec un lobe médian peu développé ou sur la marge antérieure 36

31. Clypéus légèrement échancré en avant 32
Clypéus profondément échancré en avant 33

32. Pronotum avec des callosités soulevées distinctes, irrégulières, lisses; espèces de grande taille, 11-17 mm; sur le pin; sud de la Colombie-Britannique .... ***grandis* Chamberlin** (p. 202)

Pronotum sans callosités souvelées distinctes, lisses; espèces de petite taille, 7-9 mm; sur le cèdre rouge de l'Est; Michigan ... ***neotexana* Dozier** (p. 203)

33. Pronotum sans callosités distinctes, irrégulières, lisses; sur les décidus et les arbustes; sud de la Colombie-Britannique .... ***mali* Horn** (en partie) (p. 174)

Pronotum avec des callosités soulevées distinctes, irrégulières, lisses 34

34. Dilatation sur le tibia antérieur du mâle non ou légèrement rétrécie à l'apex; dernier sternite abdominal visible chez la femelle légèrement échancré à l'apex, non limité en-dessous par une mince plaque .... ***trinervia* (Kirby)** (en partie) (p. 212)

Dilatation sur le tibia antérieur du mâle distinctement rétrécie à l'apex; dernier sternite abdominal visible chez la femelle profondément échancré, ou limité en-dessous par une mince plaque saillante 35

35. Dilatation sur le tibia antérieur du mâle graduellement rétrécie à l'apex; dernier sternite abdominal visible chez la femelle profondément et étroitement échancré à l'apex; sur le mélèze et le pin; Saskatchewan jusqu'au Nouveau-Brunswick .... ***blanchardi* Horn** (p. 203)

Dilatation sur le tibia antérieur du mâle brusquement rétrécie à l'apex; dernier sternite abdominal visible chez la femelle avec l'entaille à l'apex limitée en-dessous par une mince plaque légèrement saillante; sur le pin; sud de la Colombie-Britannique (voir aussi *caurina*, p. 000) .... ***leechi* Barr** (p. 205)

36. Espèces de grande taille, 14-17 mm de longueur 37

Espèces de petite taille, 6-13 mm de longueur 39

37. Espèces de l'Est (Manitoba jusqu'au Québec) .... ***orono* Frost** (p. 206)

Espèces de l'Ouest (sud de la Colombie-Britannique et Alberta) 38

38. Surface ventrale de l'abdomen cuivré jaune avec un lustre verdâtre; protibia du mâle avec une dilatation peu développée; sur le pin .... ***columbiana* Barr** (p. 207)

Surface ventrale de l'abdomen violette; protibia du mâle avec une entaille avant la dilatation subapicale; hôtes inconnus .... ***vulcanica* LeConte** (p. 208)

39. Surface ventrale de l'abdomen brunâtre, violacée, ou cuivré, parfois avec de faibles reflets verdâtres ou une teinte bronzée 40

Surface ventrale de l'abdomen vert brillant à vert bronzé sauf chez les femelles de *sylvania* et *laricis* dont la surface ventrale est plus ou moins violet cuivré, avec une teinte vert bronzé distincte 43

40. Tibia postérieur du mâle arqué; dernier sternite abdominal visible chez la femelle avec une large entaille à l'apex ... ***scabripennis* Gory & Laporte** (p. 209)

Tibia postérieur du mâle droit; dernier sternite abdominal visible de la femelle avec une petite entaille semi-circulaire ou triangulaire à l'apex, s'il est largement échancré alors l'entaille est limitée en-dessous par une plaque déviée 41

41. Dilatation sur le tibia antérieur du mâle brusquement rétrécie à l'apex; dernier sternite abdominal visible de la femelle avec l'entaille apicale limitée en-dessous par une mince plaque, la marge antérieure de la plaque tronquée ou sinueuse; sur le pin; sud de la Colombie-Britannique (voir aussi *leechi*, p. 205) .... ***caurina* Horn** (p. 211)

Dilatation sur le tibia antérieur du mâle non rétrécie ou faiblement à l'apex; dernier sternite abdominal visible de la femelle avec l'entaille apicale non limitée en-dessous par une mince plaque 42

42. Lobe médian de l'édéage aigu ou étroitement arrondi à l'apex (fig. 208); dernier sternite abdominal visible de la femelle avec une petite entaille semi-circulaire à l'apex; sur les conifères; transcontinental .... ***trinervia* (Kirby)** (p. 212)

Lobe médian de l'édéage tronqué à l'apex (fig. 209); dernier sternite abdominal visible de la femelle avec une très petite entaille triangulaire à l'apex; sur les conifères; Alberta (?) et Colombie-Britannique (?) .... *breviloba* **Fall** (p. 214)

43. Prosternum du mâle densément pubescent; abdomen chez la femelle violacé ou cuivré rouge, non verdâtre au milieu 44

Prosternum du mâle avec pubescence éparse; abdomen chez la femelle verdâtre au milieu, passant au violacé cuivré rouge latéralement 46

44. Costa discale et suturale des élytres formant un «Y» près de l'apex élytral; lobes latéraux de l'édéage courts et épointés (fig. 182); dernier sternite abdominal visible de la femelle subtronqué et souvent avec un petit lobe anguleux au milieu .... *beeri* **Barr** (p. 215)

Costa discale et suturale des élytres ne formant pas un «Y» près de l'apex élytral; lobes latéraux de l'édéage plus allongés, aigus à l'apex (fig. 158, 159); dernier sternite abdominal visible de la femelle profondément échancré à l'apex 45

45. Dilatation sur le tibia antérieur du mâle brusquement rétrécie à l'apex, tibia fortement resserré en arrière de la dilatation .... *laricis* **Van Dyke** (en partie) (p. 183)

Dilatation sur le tibia antérieur du mâle non brusquement rétrécie à l'apex, tibia légèrement resserré en arrière de la dilatation .... *sylvania* **Fall** (en partie) (p. 182)

46. Élytres avec les zones ponctuées cuivré rouge à noirâtres, les callosités généralement petites et nombreuses, l'apex cuivré rouge; front du mâle doré verdâtre; sur les conifères; sud de la Colombie-Britannique .... *carinipennis* **LeConte** (en partie) (p. 184)

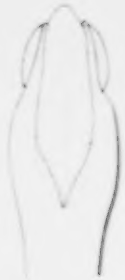
Élytres avec les zones ponctuées cuivré jaune à vertes, généralement avec 3 paires de grosses callosités irrégulières, l'apex non cuivré rouge; front du mâle vert; sur les conifères; sud de la Colombie-Britannique .... *pseudotsugae* **Van Dyke** (en partie) (p. 186)

Chrysobothris fragariae Fisher

Fig. 179

Chrysobothris fragariae Fisher, 1930:149; Fisher 1942:49; Barr 1971:76.

Description. Body uniformly dark brown, with somewhat distinct bronzy green or bronzy coppery tint; ventrally bronzy brown. Head bronzy brown, flat, with vague longitudinal carina on vertex; surface densely, irregularly punctured, punctures variable in size and well-separated, sparsely clothed with long, very fine, semierect, whitish hairs; interpuncture spaces nearly smooth. Clypeus broadly, deeply, angularly emarginate, broadly rounded laterally. Antennae uniformly bronzy brown. Pronotum about 0.75 times wider than long, widest at middle; sides arcuately converging at apical angles, parallel at middle, obliquely converging to posterior angles; disc moderately convex, without median depression; surface densely, coarsely punctured, punctures nearly confluent toward sides, sparsely clothed with moderately long, erect, inconspicuous hairs; interpuncture spaces finely, densely granulose. Elytra about 3.0 times longer than wide; sides slightly diverging from humeral angles to apical third, then arcuately converging to



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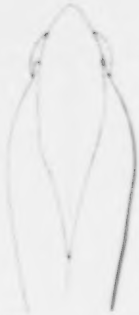

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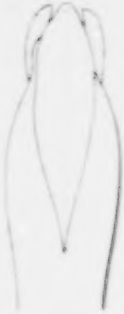

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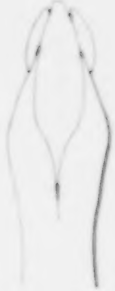

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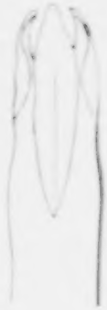

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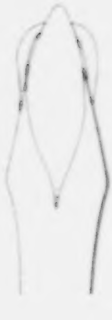

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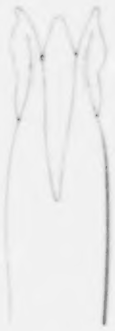

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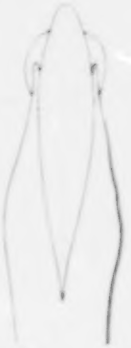

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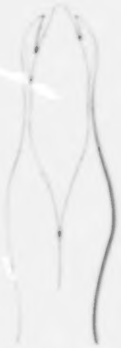

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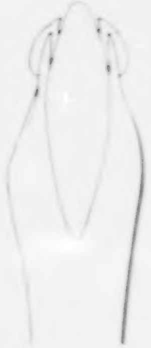

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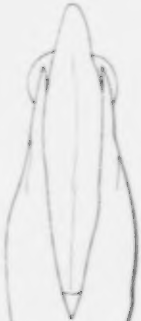

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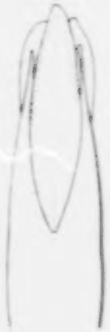

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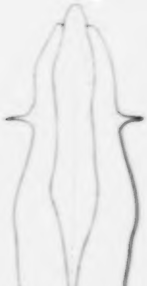

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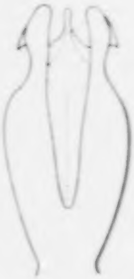

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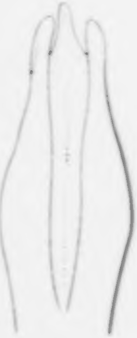

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broadly rounded apices; basal depressions not distinct; disc moderately convex; surface finely, irregularly punctate, punctures deeper basally, somewhat transversely rugose, sparsely, irregularly clothed with long, erect, whitish hairs; interspaces obsoletely granulose. Each elytron with 3 very vague foveae, one before middle and two near apical third, without distinct longitudinal costae or costae vague. Ventral surface sparsely, coarsely punctate, sparsely clothed with long, recumbent, whitish hairs; last visible abdominal sternite deeply, arcuately emarginate at apex, without submarginal ridge (♂) or vaguely emarginate at apex (♀). Anterior tibia slightly arcuate, with rounded dilation near apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 179. Length 6.4–9.4 mm.

Hosts. Reared from cultivated strawberry (*Fragaria* spp.), crowns of strawberry plants, and umbrella plant (*Eriogonum* sp.).

Distribution. Washington, Oregon, and Idaho; not recorded from Canada but should occur in southern British Columbia.

Comments. Little is known of this species. Specimens vary in having the foveae and costae on the elytra vaguely indicated to absent, the lateral margins of the last visible abdominal sternite scarcely interrupted, the elytral tips separately or conjointly rounded, the pronotum with or without a vague median depression, and the head with two vague, smooth spots on the frons.

This species can sometimes cause considerable damage to cultivated strawberries.

Chrysobothris oregona Chamberlin

Fig. 180

Chrysobothris oregona Chamberlin, 1934:38; Fisher 1942:53; Barr 1971:76.

Chrysobothris planomarginata Chamberlin, 1938:10.

Description. Body uniformly bronzy brown, with distinct coppery tinge; similar in color ventrally but more strongly shining. Head bronzy green on frons, becoming coppery brown on occiput, with a narrow, smooth, longitudinal carina on occiput; surface coarsely, densely, shallowly punctured, sparsely clothed with long, semierect, whitish hairs; interpuncture space nearly smooth. Clypeus broadly, deeply, angularly emarginate in front, broadly rounded laterally. Antennae bronzy green. Pronotum about 2.0 times wider than long, widest near apex; sides arcuately converging at apical angles,

Figs. 179–193. Aedeagi of *Chrysobothris* spp. (179–191, 193 redrawn from Fisher 1942; 192 redrawn from Manley and Wellso 1975). 179, *C. fragariae*; 180, *C. oregona*; 181, *C. mali*; 182, *C. aeneola*; 183, *C. sexsignata*; 184, *C. harrisi*; 185, *C. azurea*; 186, *C. sylvania*; 187, *C. laricis*; 188, *C. carinipennis*; 189, *C. pseudotsugae*; 190, *C. cribraria*; 191, *C. adelpha*; 192, *C. sloicola*; 193, *C. rugosiceps*.

slightly converging posteriorly, and arcuately constricted near posterior angles; disc more or less flattened, slightly uneven, with vague, elongate, median impression; surface densely, finely, irregularly punctate, somewhat rugose toward sides, sparsely clothed with short, erect hairs. Elytra about 2.0 times longer than wide; sides slightly diverging from humeral angles to behind middle, then arcuately converging to separately rounded tips; basal impressions deep and broad; humeral impressions shallow; disc moderately convex; surface densely, coarsely punctured, sparsely clothed with short, erect hairs, interspaces obsoletely granulose. Each elytron with 4 more or less distinct, smooth, longitudinal costae; first costa distinct from apex to basal fourth; second costa distinct only on apical half; third costa distinct only at middle; and fourth costa indistinct, following outline of lateral margin, also with 3 slightly impressed cupreous foveae, one interrupting second costa in front of middle, one between first and second costae on apical third, and one interrupting third costa behind middle. Ventral surface sparsely, finely, shallowly punctured, slightly rugose laterally on basal sternites, sparsely clothed with short, recumbent white hairs; last visible abdominal sternite broadly, arcuately emarginate at apex, transversely truncate in middle of emargination (♂) or broadly rounded and vaguely emarginate at apex (♀). Anterior tibiae slightly arcuate, with short, obtusely angulated dilation near apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 180. Length 6.4–10.0 mm.

Hosts. Reared from wild geranium (*Geranium* spp.) and found on slender cinquefoil (*Potentilla gracilis*) and umbrella plant (*Eriogonum* spp.).

Distribution. Southeastern British Columbia, Washington, Oregon, California, and Idaho.

Comments. This species is closely allied to *fragariae* and, in fact, the two may be the same species. Because only a few specimens of *oregona* are known, the two species are currently maintained as distinct. The aedeagi of the two species are alike, but the tooth on the anterior tibia of the male *oregona* is more angulate at the apex and the costae of the elytra are more distinct.

Nothing is known of the biology of this species.

No specimens of this species have been seen from Canada; however, Barr (1971) records it from southeastern British Columbia.

Chrysobothris mali Horn

Fig. 181; Map 42

Chrysobothris mali Horn, 1886:85; Chamberlin 1926:162; Burke 1929:1–36; Anderson 1966:253; Barr 1971:75, 78.

Description. Body brownish black to reddish coppery; ventrally reddish purple. Head bronzy green, somewhat coppery red, with smooth, longitudinal carina on occiput, a vague chevron on vertex and 2 small, smooth spots on frons; surface coarsely, deeply, densely punctured, sparsely clothed with short, recumbent, white hairs; interpuncture spaces finely, densely granulose. Clypeus broadly, deeply, angularly emarginate in front, broadly rounded laterally. Antennae bronzy. Pronotum about 2.0 times wider than long, widest near apex; sides parallel at middle, arcuately converging at apex, arcuately constricted at base; disc moderately convex, with distinct, longitudinal, median sulcus and shallow depression on each side along lateral margin; surface coarsely, densely, deeply punctured, rugose toward sides, covered with a few, short, inconspicuous hairs; interpuncture spaces indistinctly granulose. Elytra about 0.75 times longer than wide; sides slightly diverging from humeral angles to behind middle, then arcuately converging to separately broadly rounded tips; basal depressions deep; humeral depressions shallow; disc subdepressed, uneven; surface coarsely, densely punctured, sparsely clothed with short, inconspicuous hairs; interspaces densely granulose. Each elytron with 3 or 4 somewhat distinct longitudinal costae, only first strongly elevated posteriorly, and with 3 densely punctured foveae, one between first and second costae, one at end of third costa, and one near middle interrupting second costa. Ventral surface sparsely, coarsely, irregularly punctured, sparsely clothed with short, recumbent, whitish hairs; last visible abdominal sternite semicircularly emarginate at apex, without a submarginal ridge (♂) or with small, arcuate emargination at apex (♀). Anterior tibiae arcuate with a rounded dilation near apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 181. Length 6.5-11 mm.

Hosts. Many species of deciduous trees and shrubs. Recorded from (genera only): *Acer, Aesculus, Alnus, Amygdalus, Arbutus, Arctostaphylos, Betula, Ceanothus, Cerasus, Cercocarpus, Corylus, Cotoneaster, Crataegus, Cydonia, Eriobotrya, Eucalyptus, Fagus, Ficus, Juglans, Laurocerasus, Liriodendron, Malus, Osmaronia, Persea, Photinia, Pickeringia, Platanus, Populus, Prosopis, Prunus, Pyracantha, Pyrus, Quercus, Raphiolepis, Rhamnus, Ribes, Rosa, Rubus, Salix, Ulmus,* and *Wisteria*.

Distribution. Southern British Columbia to Manitoba, south through the western United States.

Comments. This species overwinters as mature larvae (prepupae). Pupation occurs in the spring and the adults emerge from late spring to summer. Eggs are laid in bark cracks and crevices. Upon hatching, the larvae bore through the bark to the phloem-cambial layer where most of the larval period is passed.

The larvae construct broad, irregular, shallow mines in both the inner bark and the outer sapwood. In smaller, thin-barked trees the galleries are deeper in the wood. Frass and boring dust is packed tightly in the gallery and shows the characteristic curved packing lines. Pupal cells are constructed in the outer sapwood. Usually there is one generation per year, but in locations where the warm season is short it may take up to 2 years to complete one life cycle (Burke 1929; Anderson 1966). The larvae have been described and illustrated by Benoit (1966*a*).

This is one of the most serious insect enemies of newly planted deciduous trees and shrubs on the Pacific slope and is commonly known as the Pacific flatheaded borer. Many newly planted trees are destroyed the 1st year after planting.

This species shows considerable variation in coloration and in the shape and sculpture of the various body regions. The dorsal surface of the body may vary from brownish black to a rather uniform coppery red. The sculpture of the elytra is variable as to the distinctness of the costae and foveae. The median sulcus on the pronotum is usually distinct but may be only vaguely indicated. Other minor variations may be encountered but need not be enumerated here.

Chrysobothris aeneola LeConte

Fig. 182

Chrysobothris aeneola LeConte, 1860:239; Fisher 1942:65.

Description. Body greenish to purplish brown, each elytron with 2 or 3 pairs of greenish foveae; ventrally purplish brown, with faint bronzy green reflection. Head bronzy green (♂) or purplish brown (♀), with a smooth, longitudinal carina on occiput; surface coarsely, densely, deeply punctured, sparsely clothed with long, recumbent, whitish hairs. Clypeus broadly, rather deeply, angularly emarginate in front, acutely rounded laterally. Antennae black, sometimes with slight bronzy green tinge. Pronotum 2.0 times wider than long, widest at basal third; sides slightly, arcuately converging at posterior angles, sinuate and nearly parallel at middle, and strongly, arcuately constricted at posterior angles; disc weakly flattened, with vague median groove, slightly impressed at middle behind anterior margin and impressed on each side near lateral margin; surface finely, deeply, densely punctate. Elytra slightly less than 2.0 times longer than wide; sides strongly diverging from humeral angles to middle, strongly expanded behind middle, then arcuately converging to broadly rounded tips; basal impressions broad and deep; humeral impressions oblong and shallow; surface finely, densely, deeply punctate, interspaces densely granulose. Each elytron with several indistinct, longitudinal costae, only seventh costa slightly elevated on apical half, others indicated by short lines, with 2 or 3 large, shallow, densely punctured foveae, one at about middle, one or two on posterior third. Ventral surface coarsely, sparsely punctured, clothed with short, recumbent, white hairs; last visible abdominal sternite broadly, deeply, arcuately emarginate at apex (♂) or shallowly, arcuately emarginate at apex (♀). Anterior tibiae arcuate, with slight dilation at apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 182. Length 7.0 mm.

Hosts. Unrecorded. Fisher (1942) reports adults flying to and boring into the base of *Eriogonum* spp.

Distribution. Poorly known. Recorded from Alberta and Saskatchewan; also reported from California, Colorado, Kansas, New Mexico, Nevada, and Wyoming (Fisher 1942).

Canadian records. Roche Percée, Sask., J. B. Wallis; Medicine Hat, Alta., F. S. Carr.

Comments. This name is applied to two specimens from Saskatchewan and one from Alberta. Both Saskatchewan specimens show a number of discrepancies when compared to the description and key as given in Fisher (1942), but they have been identified as belonging to this species by W. F. Barr and R. L. Westcott. Fisher, by necessity, had to work with inadequate material when he studied this and related species; therefore his descriptions may not be accurate.

This species, as here understood, may be recognized by the large, shallow, greenish foveae on the elytral disc, by the weakly serrate lateral margins of the elytra, by the evenly convex pronotum, which bears a narrow, median, longitudinal impression and is densely punctured and devoid of elevated callosities, and by the dark greenish to black color of the upper surface. It is similar to *C. mali* but may be distinguished by the characters given in the key.

These specimens will run to *C. fragariae* in Fisher's key but differs by the characters given in the foregoing key.

Chrysobothris chlorocephala Gory

Chrysobothris chlorocephala Gory, 1841:161; Fisher 1942:119 (as synonym of *harrisi*); Nelson 1980:88.

Chrysobothris concinnula LeConte, 1860:238; Fisher 1942:226; Craighead 1950:195.

Description. Body violet brown, with distinct bluish or bronzy green tinge; pronotum slightly greenish laterally; elytra with violet blue spots; ventrally bluish or purplish black, with sternum and legs, in part, bronzy green. Head bright green (♂) or uniformly violaceous (♀), with obscure, smooth, longitudinal carina on occiput, carina vaguely bifurcate on vertex; frons slightly convex; surface very coarsely, deeply, irregularly, confluently punctate, indistinctly pubescent. Clypeus deeply, narrowly, angularly emarginate in front, obliquely truncate laterally. Antennae coppery, with basal segments greenish. Pronotum wider than long, widest near apex; sides strongly arcuate near apices, obliquely converging and slightly sinuate; disc slightly convex, without impressions or callosities; surface sparsely, irregularly punctate at middle, more coarsely, deeply punctured laterally, weakly, transversely rugose, interspaces densely granulose. Elytra about 2.0 times longer than wide; sides strongly diverging from humeral angles to behind middle, then arcuately converging to broadly rounded tips; basal impressions broad, deep; humeral impressions vague; surface glabrous, without longitudinal costae, coarsely, deeply but not densely punctate; interspaces densely granulose. Each elytron with 2 or 3 blue spots. Ventral surface coarsely, sparsely, shallowly punctate, indistinctly pubescent; last visible abdominal sternite broadly truncate at apex, with angles slightly produced, and with an indistinct submarginal ridge (♂) or more elongate, sinuately truncate at apex (♀), lateral margin not serrate. Anterior and middle tibiae arcuate, anterior with long, narrow dilation at apex (♂) or unarmed (♀). Length 5.5–7.0 mm.

Hosts. Oak (*Quercus* spp.) and *Vitis* spp.

Distribution. Eastern United States from Georgia to New York and Michigan. Not recorded from Canada but should occur in southern Ontario.

Comments. This species is included herein based on data supplied to me by G. H. Nelson, who recorded this species from Michigan on white oak, *Quercus alba* (pers. comm., 1983).

The color on the dorsal surface of the body of this species is uniform, but the pronotum may be slightly more greenish and the elytra more brownish in some specimens, and the color of the elytral spots varies from violet blue to greenish blue.

Nothing is known of the habits or life history of this species.

Chrysobothris sexsignata (Say)

Fig. 183; Map 39

Buprestis sexguttata Say, 1823:161 (preoccupied).

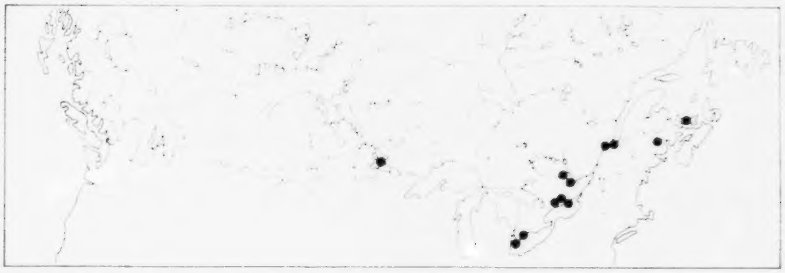
Buprestis sexsignata Say, 1839:158.

Chrysobothris sexsignata: Knull 1925:33; Chamberlin 1926:171; Craighead 1950:195; Fisher 1942:224.

Chrysobothris ignipes Gory and Laporte, 1841:50.

Chrysobothris germari Gory and Laporte, 1841:50.

Description. Body blackish with distinct bronzy green and purplish tinges, each elytron with 3 impressed greenish to coppery foveae; ventrally bluish green, with sides and, in part, legs coppery brown. Head bright green, becoming coppery brown on vertex and occiput (♂), or purplish brown with lateral margins and anterior margin of clypeus greenish (♀), with vague longitudinal carina on occiput, very small, indistinct chevron on vertex and a broad, transverse elevation below chevron; surface coarsely, rather densely, irregularly punctate, sparsely clothed with long, suberect, inconspicuous hairs. Clypeus deeply, angularly emarginate in front, subtruncate laterally. Antennae bright green to bronzy green (♂) or purplish brown with bronzy green tinge (♀). Pronotum nearly 2.0 times wider than long, widest near apex; sides slightly, obliquely converging from near apical angles to posterior angles; disc slightly convex, with vague, median impression posteriorly, and transverse impression on each side behind anterior margin; surface coarsely, transversely rugose, densely granulose, sparsely, coarsely punctured between rugae, with a few, short, inconspicuous hairs laterally. Elytra about 2.0 times longer than wide; sides slightly diverging from humeral angles to behind middle, then arcuately converging to separately, narrowly rounded tips; basal impressions broad, deep; humeral impressions broad, shallow; surface glabrous, coarsely, densely, irregularly punctate, interspaces smooth. Each elytron with 4 smooth, longitudinal costae; first costa distinct, sinuate



Map 39. Collection localities of *Chrysobothris sexsignata*.

near apex, extending from base to apex; second and third costae slightly elevated, broadly interrupted; fourth costa distinct, following outline of lateral margin; surface with 3 impressed foveae, one in basal impression, one in front of middle in second costa, and one at apical third of third costa. Ventral surface finely, sparsely punctured at middle, more densely punctate laterally, rather densely clothed with moderately long, recumbent hairs; last visible abdominal sternite broadly, deeply, arcuately emarginate at apex (♂) or shallowly, arcuately emarginate at apex (♀). Anterior tibiae slightly arcuate, unarmed at apex in both sexes. Aedeagus as in Fig. 183. Length 6.5–12.5 mm.

Hosts. Recorded in the literature from red maple (*Acer rubrum*), American chestnut (*Castanea dentata*), yellow birch (*Betula alleghaniensis*), beech (*Fagus* spp.), black ash (*Fraxinus nigra*), white ash (*Fraxinus americana*), hickory (*Carya* spp.), black walnut (*Juglans nigra*), butternut (*Juglans cinerea*), tamarack (*Larix laricina*), pitch pine (*Pinus rigida*), oak (*Quercus* spp.), bald cypress (*Taxodium distichum*), and eastern hemlock (*Tsuga canadensis*).

Distribution. Southern Ontario to Prince Edward Island, south to Florida and west to Nebraska and Oklahoma and possibly eastern Colorado.

Comments. The color of the impressed foveae on the elytra varies from golden green to purplish coppery and sometimes may be the same color as the remainder of the surface. The abdomen is usually bright blue green in the middle but sometimes the entire surface is coppery brown. Other slight variations can be seen in the structure of the apex of the last visible abdominal segment of the female and in the shape of the pronotum.

The larvae are described in Benoit (1964).

Nothing is known of the biology of this species.

Chrysobothris azurea LeConte

Fig. 185

Chrysobothris azurea LeConte, 1857:8; Fisher 1942:221; Craighead 1950:195; Barr 1971:73.

Chrysobothris lecontei Leng, 1920:182; Chamberlin 1926:159; Fisher 1942:221.

Description. Body uniformly purplish blue to purple dorsally and ventrally, sometimes greenish in middle ventrally, reddish laterally. Head green, becoming coppery or purplish on occiput (♂) or purplish blue (♀); surface coarsely, deeply, irregularly, confluently punctate, clothed with few inconspicuous hairs. Clypeus broadly, deeply, triangularly emarginate in front, subtruncate laterally. Antennae bronzy green with golden tinge (♂) or greenish (♀). Pronotum about 0.6 times wider than long, widest near base; sides arcuately converging at apical and posterior angles; disc moderately convex, without impressions or callosities; surface coarsely, deeply, densely punctured, transversely rugose, interspaces finely granulose. Elytra about 2.0 times longer than wide; sides strongly diverging from humeral angles to behind middle, then arcuately converging to separately, narrowly rounded tips; basal impressions broad and deep; humeral impressions broad and shallow; surface glabrous, coarsely, deeply, densely punctate, somewhat rugose at sides, interspaces indistinctly granulose. Each elytron with costae represented by vaguely elevated, indistinct, longitudinal, not smooth lines; surface with 2 slightly impressed foveae, one in front of middle, one on apical third. Ventral surface sparsely, finely, irregularly punctate, sparsely clothed with short, inconspicuous hairs; last visible abdominal sternite broadly, deeply, arcuately emarginate at apex, indistinctly carinate at middle (♂) or broadly, shallowly emarginate and longitudinally carinate at middle (♀). Anterior tibiae moderately arcuate (♂) or slightly arcuate (♀), unarmed at apex in both sexes. Aedeagus as in Fig. 185. Length 5.5–9.0 mm.

Hosts. Recorded in the literature from maple (*Acer* spp.), speckled alder (*Alnus rugosa*), paper birch (*Betula populifolia*), flowering dogwood (*Cornus florida*), hawthorn (*Crataegus* spp.), hickory (*Hicoria* spp.), pine (*Pinus* spp.), oak (*Quercus* spp.), sumac (*Rhus* spp.), willow (*Salix* spp.), American basswood (*Tilia americana*), and *Wisteria chinensis*. Nelson et al. (1981) state it was reared from dead *Amelanchier arborea*.

Distribution. Eastern United States from Maine to Michigan, south to Virginia, Arkansas, and Missouri; recorded from Manitoba (Criddle 1926) and rarely encountered in southeastern British Columbia and northern Idaho (Barr 1971). One specimen at hand is from Fort Qu'Appelle, Sask., from Saskatoon berries, and one specimen has been seen from Ottawa, Ont.

Comments. The color of the dorsal surface of the body of adults of this species varies from purplish blue to purple, and the ventral surface of the body is frequently bright green in the middle, becoming reddish laterally. The color on the front of the head in the female varies from purplish blue to purple, with the margins somewhat greenish. Frequently there is a vague longitudinal carina on the vertex and on the occiput. Other slight variations in the shape of the pronotum and in the sculpturing of the various body surfaces may be encountered.

Nothing is known of the life history or biology of this species.

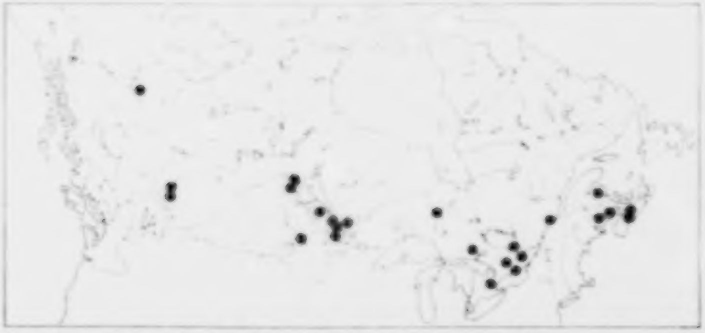
Chrysobothris harrisi (Hentz)

Fig. 184; Map 40

Buprestis harrisi Hentz, 1827:373.

Chrysobothris harrisi: Knull 1925:29; Chamberlin 1926:157; Craighead 1950:195; Fisher 1942:119.

Description. Body bronzy green to purple, slightly bluish, with lateral areas of pronotum coppery red; ventrally bronzy green, somewhat brownish to purplish coppery. Head coppery red (♂) or bluish green (♀), with obscure, narrow, longitudinal carina on occiput; surface coarsely, deeply, densely punctate, sparsely clothed with moderately long, erect hairs, interspaces indistinctly granulose. Clypeus deeply, broadly, triangularly emarginate, rounded on each side. Antennae bronzy brown (♂) or bronzy green (♀). Pronotum 2.0 times wider than long, widest at middle; sides parallel, slightly sinuate at middle, arcuately converging toward base and apex; disc moderately convex, slightly uneven, with narrow, longitudinal, median impression and shallow, broad impression on each side near lateral margin; surface densely, deeply, irregularly punctured, somewhat transversely rugose at sides, interspaces vaguely granulose. Elytra about 2.0 times longer than wide, widest behind middle; sides slightly diverging from humeral angles to behind middle, then converging to broadly rounded apices; basal and humeral impressions broad, deep, separated by narrow elevation; surface glabrous, coarsely, deeply punctured, interspaces vaguely granulose. Each elytron with 4 indistinct, longitudinal costae; first costa slightly elevated on apical half; second and third costae obsolete, broadly interrupted, replaced on apical half



Map 40. Collection localities of *Chrysobothris harrisi*.

by narrow, irregular, smooth spaces; fourth costa weakly elevated, following outline of lateral margin. Ventral surface densely, coarsely punctured, sparsely clothed with short, recumbent hairs; last visible abdominal sternite semicircularly emarginate at apex, without a submarginal ridge (♂) or slightly notched at apex (♀). Anterior tibiae slightly arcuate, with rounded dilation near apex (♂), or unarmed at apex (♀). Aedeagus as in Fig. 184. Length 6.5-9.0 mm.

Hosts. Recorded from pine (*Pinus* spp.).

Distribution. Northern British Columbia, east through the coniferous forests to New Brunswick and Nova Scotia, south in the eastern United States to Alabama and Florida.

Comments. Adults of this species vary in color from light green to dark purplish blue. The clypeus is more shallowly emarginate in some specimens. The median sulcus on the pronotum may be only slightly indicated or somewhat distinct. The tip of the last visible abdominal sternite of the female may be rounded or slightly notched.

Nothing is recorded concerning the habits or life history of this species.

Chrysobothris sylvania Fall

Fig. 186

Chrysobothris sylvania Fall, 1910:50; Chamberlin 1926:173; Fisher 1942:187; Barr 1971:74, 81.

Description. Body blackish on elevated, smooth spaces, bronzy green to brownish in densely punctured areas; ventrally bright green, laterally violaceous (♂) or purplish coppery with a bronzy green reflection (♀). Head yellowish coppery in front (♂) or coppery with violaceous tinge (♀), with distinct, smooth, longitudinal carina on occiput and pair of small, smooth callosities on frons; surface coarsely, deeply punctate, densely clothed with long, fine, erect, brownish hairs. Clypeus broadly, deeply, angularly emarginate in front, arcuately rounded laterally. Antennae bright green (♂) or blackish with a bronzy tinge (♀). Pronotum about 2.0 times wider than long, widest along middle; sides parallel, sinuate at middle, arcuately converging to apex and base; disc convex, uneven, with broad, longitudinal, median sulcus limited on apical half on each side by broad, elevated, smooth space, a small, smooth callosity is on each side of elytral lobe and broad, median impression laterally; surface coarsely, deeply punctate between smooth callosities. Elytra about 2.0 times longer than wide; sides nearly parallel from humeral angles to apical third, arcuately converging to broadly rounded apices; basal impressions broad, very deep; humeral impressions broad, shallow; surface glabrous, with numerous small, irregular, smooth spaces connected laterally to costae, densely, finely punctured between smooth spaces. Each elytron with 4 more or less distinct, longitudinal costae; first costa distinct, narrow, strongly elevated, slightly sinuate, extending from base to apex; second, third, and fourth costae moderately distinct, narrow, smooth, strongly sinuate, broadly interrupted by numerous densely punctured areas. Ventral surface densely, coarsely punctate; last visible abdominal sternite deeply, semicircularly emarginate at apex (♂) or narrowly emarginate at apex (♀). Anterior tibiae strongly arcuate, with long, rounded dilation, slightly narrowed near apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 186. Length 11.3–12.0 mm.

Hosts. Recorded from Douglas-fir (*Pseudotsuga menziesii*).

Distribution. Southern British Columbia to California.

Canadian record. Sidney, B.C., on Douglas-fir.

Biology. The following notes are taken from a study conducted in central Oregon (Chamberlin 1920*b*). In general, they are probably applicable in Canada.

Eggs are deposited in bark crevices or under bark scales in late April and May. The minute larvae enter the bark, work to the cambium, and extend their galleries through the cambium, bark, or wood throughout the remainder of the year. Pupation takes place in the spring of the next year and the adults emerge in early April to renew the cycle.

Several kinds of larval mines are constructed. Some larvae mine in the cambium for only a short time, then enter the sapwood and often work into the heartwood. Others appear to spend their entire larval period in the cambial layer. A pupal cell is constructed below the cambium, always parallel to the surface and with the grain of the wood. Larval mines are packed with borings and excrement but apparently lack the concentric appearance of the packings in the mines of many of the buprestids.

The eggs, larvae, and pupae are described by Chamberlin (1920*b*).

Comments. The color in the punctuate areas on the dorsal surface of the body varies from coppery brown to bronzy green. Frequently the lateral depressions on the pronotum are indistinct, and the surface is ornamented with four small, irregular callosities arranged transversely in front of the middle. Other variations were not detected.

Chrysobothris laricis Van Dyke

Fig. 187

Chrysobothris laricis Van Dyke, 1916:409; Chamberlin 1926:159; Fisher 1942:184; Barr 1971:74, 80, 81.

Description. Body shining, blackish with distinct purplish tinge on smooth, elevated spaces, bronzy green in punctured areas; ventrally bronzy green, faintly purplish laterally (♂) or purplish coppery, with bronzy green tinge (♀). Head bronzy green (♂) or purplish brown (♀), with distinct, smooth, longitudinal carina on occiput and pair of small callosities on frons; surface coarsely, densely punctured, with long, erect, inconspicuous hairs. Clypeus broadly, deeply, angularly emarginate in front, arcuately rounded laterally. Antennae bronzy green (♂) or purplish brown (♀). Pronotum about 2.0 times wider than long, widest near middle; sides parallel, sinuate at middle, arcuately converging to apex and base; disc convex, uneven, with shallow, poorly defined, median sulcus, limited anteriorly on each side by obscure, irregular callosity; surface coarsely, densely punctate, transversely rugose laterally. Elytra about 2.0 times longer than wide; sides slightly converging from humeral angles to behind middle, arcuately converging to broadly rounded apices; basal and humeral impressions broad and deep; surface glabrous, coarsely, densely punctate between costae and elevated, smooth spaces. Each elytron with 4 more or less distinct, longitudinal costae; first costa poorly developed anteriorly, distinct and strongly elevated posteriorly; second and third costae irregular, somewhat flattened, more or less interrupted; fourth costa sinuate, following outline of lateral margin; all costae joined by irregular, transverse, smooth spaces. Ventral surface densely, coarsely punctured; last visible abdominal sternite deeply, semicircularly emarginate at apex (♂) or narrowly, arcuately emarginate at apex (♀). Anterior tibiae strongly arcuate, with elongate, arcuate dilation, narrowed at apex (♂) or tibiae unarmed at apex (♀). Aedeagus as in Fig. 187. Length 8.0–12.0 mm.

Hosts. Recorded from western larch (*Larix occidentalis*), lodgepole pine (*Pinus contorta*), and Douglas-fir (*Pseudotsuga menziesii*).

Distribution. Southern British Columbia to central California.

Comments. Van Dyke (1916) reports that some specimens of this species may be more coppery and brilliantly metallic, the transverse punctate areas on the elytra may be more definitely defined, the sutural elevations may be widely explanate near the apex, and the dilated portion of the anterior tibiae of the male may be less broad.

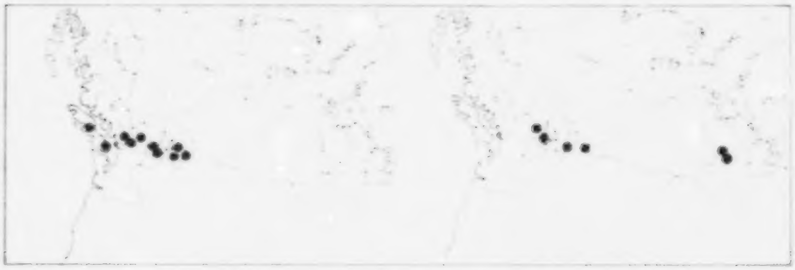
Nothing is recorded of the life history or biology of this species.

Chrysobothris carinipennis LeConte

Fig. 188; Map 41

Chrysobothris carinipennis LeConte, 1878:459; Chamberlin 1926:141; Fisher 1942:189; Barr 1971:74.

Description. Body blackish with faint violaceous black reflection on smooth spaces; ventrally dark green, with faint bronzy tinge and slightly purplish laterally. Head green with faint yellowish coppery tinge (♂) or purplish coppery, with slight greenish tinge (♀), with distinct, smooth, longitudinal carina on occiput and pair of small, obscure callosities on frons; surface coarsely, deeply punctured, densely clothed with moderately long, erect hairs. Clypeus broadly, deeply, arcuately emarginate in front, arcuately rounded laterally. Antennae bronzy green (♂) or blackish with faint greenish reflection (♀). Pronotum 2.0 times wider than long, widest along middle; sides parallel at middle, arcuately converging to apex and base; disc convex,



Maps 41, 42. 41, Collection localities of *Chrysobothris carinipennis*; 42, *C. mali*.

uneven, with obscure, broad, longitudinal, densely punctured median sulcus, limited on each side on apical half by broad, elevated, smooth callosity and with numerous, small, irregular, smooth callosities laterally; surface coarsely, deeply, irregularly punctate between callosities. Elytra about 2.0 times longer than wide; sides parallel from humeral angles to apical third, arcuately converging to broadly rounded apices; basal impressions broad, very deep; humeral impressions broad, less deep; surface glabrous, uneven, spaces between costae of finely, densely punctured areas and smooth spaces joined to costae. Each elytron with 4 more or less distinct costae; first costa distinct, straight, extending from basal impression to apex; second and third costae irregular, moderately distinct, interrupted by punctured spaces; fourth costa sinuate, indistinct, extending along lateral margin from behind humerus to near apex where it is united to second costa. Ventral surface finely, sparsely punctured; last visible abdominal sternite deeply, semicircularly emarginate at apex (♂) or broadly, shallowly emarginate at apex (♀). Anterior tibiae arcuate, with long, weak dilation at apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 188. Length 10.5–13.0 mm.

Hosts. Reared from Douglas-fir (*Pseudotsuga menziesii*). Recorded in literature from several species of pine (*Pinus* spp.) and western larch (*Larix occidentalis*), but because a number of species have been confused with *carinipennis* these records should be verified.

Distribution. Southern British Columbia to Arizona; also recorded from various locations in many western states. These records need to be confirmed.

Comments. The color in the punctate areas on the dorsal surface of the body is usually blackish but may vary from reddish coppery to bronzy green, and on the front of the head in the male from green through yellowish green to reddish coppery. Other minor variations in sculpture were noted.

Nothing is known of the habits or life history of this species.

Chrysobothris pseudotsugae Van Dyke

Fig. 189

Chrysobothris pseudotsugae Van Dyke, 1916:407; Chamberlin 1926:166; Fisher 1942:191; Barr 1971:74.

Description. Body blackish on smooth, elevated spaces, bronzy green in punctured areas; ventrally dark green, slightly purplish laterally. Head bronzy green (♂) or purplish coppery (♀), with distinct, smooth, longitudinal carina on occiput and a pair of small callosities on frons; surface coarsely, deeply punctured, densely clothed with long, erect hairs. Clypeus broadly, deeply, subangularly emarginate in front, arcuately rounded laterally. Antennae bronzy green. Pronotum about 2.0 times wider than long, widest along middle; sides parallel, sinuate at middle, slightly converging to base and apex; disc convex, with broad, longitudinal, densely punctured median sulcus, limited laterally on apical half by a broad, elevated, smooth callosity, laterally between this callosity and lateral margin is an irregular, smooth, longitudinal callosity that is broadly interrupted at middle; surface coarsely, densely punctate between smooth callosities. Elytra about 2.0 times longer than wide; sides nearly parallel from humeral angles to apical third, arcuately converging to broadly rounded tips; basal impressions broad, very deep; humeral impressions broad, shallow; surface glabrous, uneven, densely, finely punctate between elevated, smooth callosities. Each elytron with 4 more or less distinct longitudinal costae; first costa distinct, narrow, strongly elevated posteriorly, broader and flatter anteriorly; second and third costae less distinct, irregular, broadly interrupted; fourth costa indistinct, irregular, following outline of lateral margin; all costae joined to one another by irregular, smooth, transverse spaces. Ventral surface sparsely, coarsely punctured; last visible abdominal sternite deeply, semicircularly emarginate at apex (♂) or broadly, shallowly, arcuately emarginate at apex (♀). Anterior tibiae arcuate, with short, elongate dilation at apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 189. Length 10.0–13.0 mm.

Hosts. Reared from Douglas-fir (*Pseudotsuga menziesii*), adults collected from white fir (*Abies concolor*), grand fir (*A. grandis*), ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*P. jeffreyi*), and mountain hemlock (*Tsuga mertensiana*).

Distribution. Southern British Columbia to California.

Canadian records. Frye Creek and Merritt, B.C.

Comments. Adults of this species are very difficult to distinguish from those of *carinipennis*. The characters given in the key may assist but will not hold true for many specimens because of variation. The best characters are on the male aedeagus, which in *pseudotsugae* is more slender, with the sides of the median lobe strongly, obliquely narrowed to the rather acutely rounded apex (Fig. 189), whereas in *carinipennis* the male aedeagus is distinctly broader, with the sides of the median lobe slightly narrowed to the broadly rounded apex (Fig. 188).

The color in the punctured areas on the dorsal surface of the body varies from reddish coppery to bronzy green. Other minor variations in sculpture were noted.

Nothing is known of the habits or life history of this species.

Chrysobothris cribraria Mannerheim

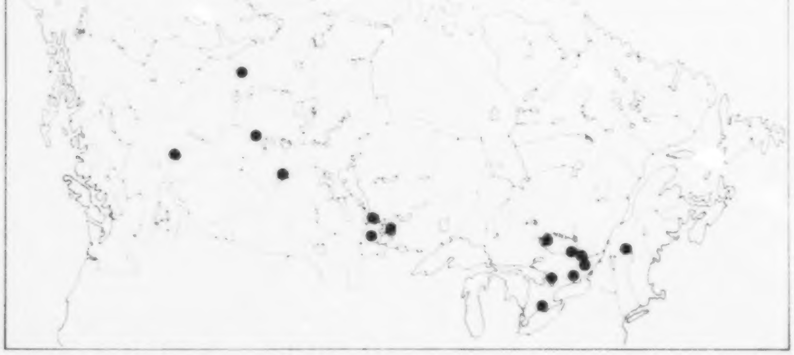
Fig. 190; Map 43

Chrysobothris cribraria Mannerheim, 1837:77.

Chrysobothris floricola Gory, 1841:179; Knull 1925:29; Chamberlin 1926:155; Fisher 1942:128; Craighead 1950:195.

Chrysobothris calcarata Melsheimer, 1845:146.

Description. Body bronzy coppery; ventrally coppery brown, with purplish reflection, legs greenish. Head coppery brown, bronzy green behind clypeus and along lateral margins, with small, irregular, smooth callosities on frons and narrow, longitudinal, smooth carina on occiput; surface coarsely, densely punctate, sparsely clothed with long, semierect, fine hairs, interspaces finely granulose. Clypeus transversely sinuate in front, with short, broad, subtruncate, median lobe. Antennae bronzy green. Pronotum about 2.0 times longer than wide, widest along middle; sides sinuate and nearly parallel at middle, converging toward base and apex; disc uneven, with broad, longitudinal, median impression and vague rounded impression on each side; surface coarsely, irregularly punctate. Elytra about 1.6 times longer than wide; sides nearly parallel from humeral angles to apical third, then converging to broadly rounded apices; basal impressions broad, very deep; humeral impressions broad, shallow; surface glabrous, coarsely, deeply punctured. Each elytron with 4 vague to distinct longitudinal costae; first costa distinct,



Map 43. Collection localities of *Chrysobothris cribraria*.

elevated from base to apex; second and third costae irregular and broadly interrupted by foveae; fourth costa vague, following outline of lateral margin. Ventral surface sparsely, finely punctate, sparsely clothed at sides with short, recumbent hairs; last visible abdominal sternite broadly, deeply, arcuately emarginate at apex (♂) or broadly emarginate at apex with emargination transverse and crenulate at bottom (♀). Anterior tibiae slightly arcuate, with a large, triangular tooth near apical third (♂) or tibiae unarmed (♀). Aedeagus as in Fig. 190. Length 7.5–13.5 mm.

Hosts. Known from pine (*Pinus* spp.).

Distribution. Alberta and the Northwest Territories, east to Quebec and Ontario, south through the eastern United States to Texas and Florida.

Comments. Very little variation is recorded for this species except in size and color. Northern specimens tend to be darker than those from southern localities.

Nothing is known of the habits or life history of this species.

femorata complex

The following five species form the *femorata* complex. All are similar in appearance to *femorata*; therefore the more complete description is given only for *femorata*, the most common and widespread member of the complex.

Chrysobothris adelpha Gemminger & Harold

Fig. 191

Chrysobothris soror LeConte, 1860:232 (preoccupied).

Chrysobothris adelpha Gemminger and Harold, 1869:1423; Fisher 1942:130.

Description. Differs from *femorata* by having the clypeus not semicircularly rounded laterally, by having the last visible sternite of the female strongly, transversely sinuate at the apex, and by having the eighth abdominal tergite of the female only slightly depressed on each side of median carina. Aedeagus as in Fig. 191. Length 9.0–15.0 mm.

Hosts. Recorded from hickory (*Carya* spp.).

Distribution. Southern Ontario and Quebec within the range of hickory.

Comments. Nothing is known of the biology or life history of this uncommon species.

The larvae have been described by Benoit (1964).

Chrysobothris sloicola Manley & Wellso

Fig. 192

Chrysobothris sloicola Manley and Wellso, 1975:317; Wellso et al. 1976:11.

Description. Differs from *femorata* by the shape of the male aedeagus (Fig. 192). Length 9.0–11.0 mm.

Hosts. Recorded only from American plum (*Prunus americana*).

Distribution. Known only from Shiawassee County, MI, but may occur in the extreme southern Ontario.

Comments. This species is known from only the five specimens in the type series. It is included here because its host plant ranges into southern Ontario and the type locality is actually north of the southern extremity of Ontario. The species possibly occurs from the Windsor area to at least the Niagara Peninsula.

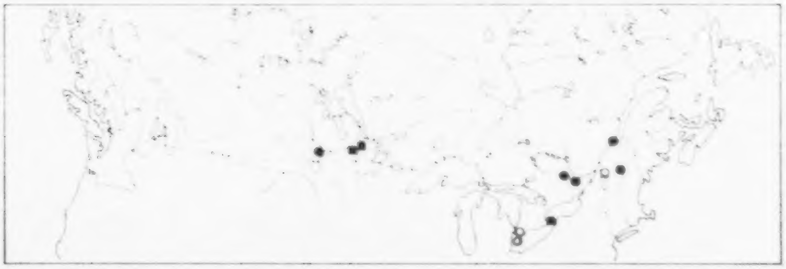
Chrysobothris rugosiceps Melsheimer

Fig. 193; Map 44

Chrysobothris rugosiceps Melsheimer, 1845:147; Fisher 1942:131; Wellso et al. 1976:11.

Description. Differs from *femorata* by the antennae not being distinctly narrowed to apex, by the last segment of the antennae being quadrate and as wide as the 10th segment, by the carina on the female eighth abdominal tergite extending beyond the apical notch, and by the shape of the aedeagus (Fig. 193). Length 9.0–16.0 mm.

Hosts. Known only from American chestnut (*Castanea dentata*) and oak (*Quercus* spp.).



Map 44. Collection localities of *Chrysobothris rugosiceps* (•), *C. adelpha* (○), and *C. viridiceps* (■).

Distribution. Manitoba to Quebec and the eastern United States. Fisher (1942) also gives Manitoba but no exact locality.

Comments. Adults of this species closely resemble those of *femorata* and the differences previously noted may only be normal variations within *femorata*.

Chrysobothris viridiceps Melsheimer

Fig. 194; Map 44

Chrysobothris viridiceps Melsheimer, 1845:147; Fisher 1942:132; Wellso et al. 1976:11.

Description. Differs from *femorata* by having the ventral side of the body and legs more greenish, by the pale yellow outer margins of the male antennal segments, by the unicolored elytral disc and apex, by the posterior pair of foveae separated by a longitudinal costa, and by the shape of the aedeagus (Fig. 194). Length 8.0–13.0 mm.

Hosts. Recorded from red maple (*Acer rubrum*), oak (*Quercus* spp.), and cherry (*Prunus* spp.).

Distribution. Eastern United States, north to Michigan and Minnesota; may occur in southern Canada.

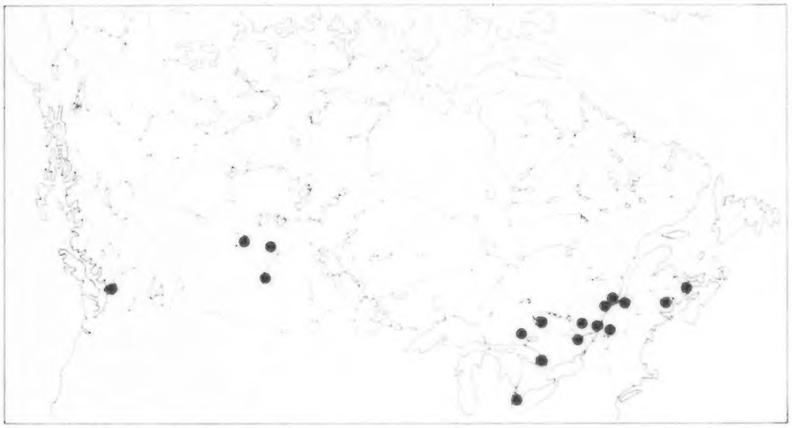
Chrysobothris femorata (Olivier)

Figs. 51, 195; Map 45

Buprestis femorata Olivier, 1790:47 (actually preoccupied by *B. femorata* Villers, 1789).

Chrysobothris femorata: Knull 1925:28; Chamberlin 1926:150; Fisher 1942:133; Fenton 1942:1–31; Craighead 1950:194; Anderson 1966:253; Baker 1972:165; Wellso et al. 1976:11.
Buprestis insculpta Herbst, 1801:145.
Chrysobothris quadriimpressa Gory and Laporte, 1841:48.
Chrysobothris lesueuri Gory and Laporte, 1841:49.
Chrysobothris dentipes Gory and Laporte (not Germar), 1841:52.
Chrysobothris nigritula Gory and Laporte, 1841:54.
Chrysobothris alabamae Gory, 1841:185.
Chrysobothris obscura LeConte, 1860:232.
Chrysobothris misella LeConte, 1873:233.

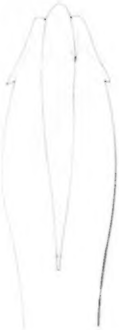
Description. Body greenish to purplish black, with distinct coppery red tinge; ventrally coppery red, with slight greenish tinge. Head coppery brown to bronzy green, with a broad, smooth, longitudinal carina on occiput, and frequently with 2 small callosities or chevrons on frons; surface coarsely punctured, rather densely clothed with long, erect, white hairs. Clypeus acutely



Map 45. Collection localities of *Chrysobothris femorata*.

notched at middle, semicircularly rounded laterally. Antennae bronzy green basally, becoming coppery red toward apex (♂), or uniformly coppery red, sometimes with faint greenish tinge (♀). Pronotum 2.0 times wider than long, widest near apex; sides nearly parallel and sinuate along middle, converging toward base and apex; disc uneven, with faint, longitudinal, median impression; surface densely, irregularly punctate, with numerous, slightly elevated, smooth spaces. Elytra about 2.0 times longer than wide; sides slightly diverging from humeral angles to behind middle, then arcuately converging to narrowly rounded apices; basal impressions broad, deep; humeral impressions broad, shallow; surface glabrous, coarsely, densely, irregularly punctate. Each elytron with 4 distinct to vague longitudinal costae, connected by transverse, irregular, smooth spaces, and with 2 slightly impressed, transverse foveae, one near middle, one on apical third. Ventral surface sparsely, coarsely punctured, sparsely clothed with short, semierect, white hairs; last visible abdominal sternite semicircularly emarginate at apex (♂) or broadly, arcuately emarginate and tridentate at apex, with median projection long and narrow, and lateral projections broadly rounded (♀). Anterior tibiae with numerous small teeth on inner margins (♂) or unarmed (♀). Aedeagus as in Fig. 195. Length 7.6–16.0 mm.

Hosts. Recorded from a great variety of forest and fruit trees: maple (*Acer* spp.), peach (*Prunus persica*), American chestnut (*Castanea dentata*), hackberry (*Celtis occidentalis*), redbud (*Cercis japonica*), green ash (*Fraxinus pennsylvanica*), black walnut (*Juglans nigra*), sweetgum (*Liquidambar styraciflua*), apple (*Malus* spp.), sycamore (*Platanus occidentalis*), poplar (*Populus* spp.), plum (*Prunus domestica*), oak (*Quercus* spp.), willow (*Salix* spp.), and mountain ash (*Sorbus* spp.). Some of the foregoing records may refer to other species in the complex.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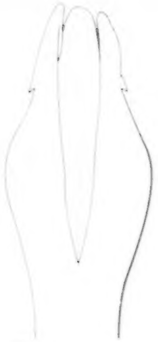
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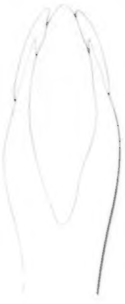
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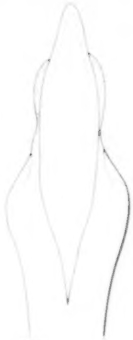
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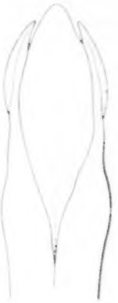
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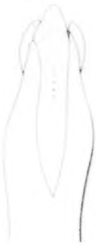
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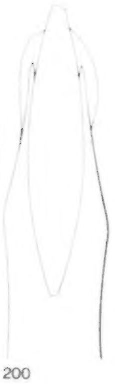
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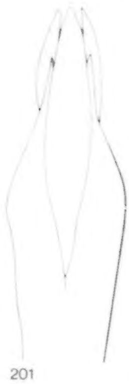
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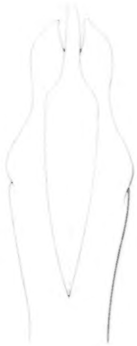
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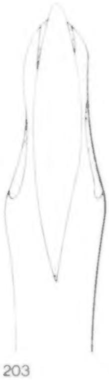
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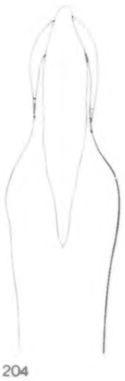
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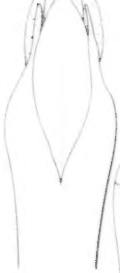
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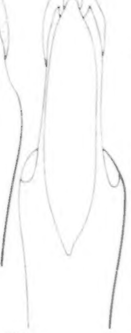
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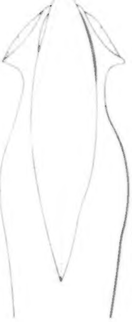
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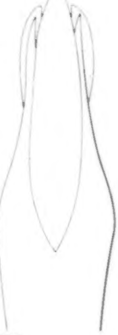
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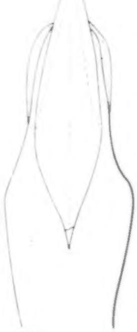
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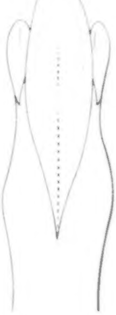
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Distribution. Transcontinental in Canada and United States but evidently more common in the east; also found in Mexico.

Comments. This species is commonly known as the flatheaded appletree borer. The life history and damage have been reported on by Fenton (1942). Adults appear throughout the summer and feed on the foliage of their host trees, and when abundant can cause severe defoliation. Eggs are deposited under bark scales, in crevices, or in other bark irregularities on the main trunk and on the larger limbs. The larvae bore into the bark and feed in the phloem and outer sapwood. In younger trees, the larval galleries may be 5 cm, or more, long. In older trees, the galleries are mostly confined to the thick inner bark. The larvae overwinter in pupal cells, which are constructed in the outer wood, and pupate the following spring. There is one generation a year in the southern portions of the range but this may be extended in Canada.

This species can be destructive to newly planted trees or trees weakened by drought, defoliation, or other factors. Young trees may be girdled and killed; older trees may be injured by the loss of large areas of bark over mined areas.

The larvae are described by Benoit (1964).

As can be seen from the number of synonyms, this is a very variable species. Most of the variability is in the size, color, sculpture of the general body, and in the color and shape of the foveae on the elytra. The color of the head may vary from bronzy green to bronzy coppery. The foveae on the elytra vary in color from bright green to reddish coppery and are sometimes divided by the costae. Numerous other variations on the male genitalia, the eighth abdominal tergite of the female, and the shape and sculpture of the pronotum and elytra could be noted.

The entire *femorata* complex needs to be completely reviewed. Some of the species may be only well-marked geographical variants or, in fact, may be sexually isolated species. Fisher (1942) states that this species seems to be in a high (or rapid) state of evoluation; therefore interbreeding may take place between the different forms, and intermediate forms can be expected to occur.

One year before Olivier (1790) described *Buprestis femorata* (now *Chrysobothris*), Villers (1789) described a *Buprestis femorata*, now a synonym of *Anthaxia hungarica* (Scopoli), a palearctic species. The result of this is that our familiar *C. femorata* actually bears an unavailable name and should

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Figs. 194–210. Aedeagi of *Chrysobothris* spp. (194–205, 207–209 redrawn from Fisher 1942; 206, 210 redrawn from Barr 1969*b*). 194, *C. viridiceps*; 195, *C. femorata*; 196, *C. semisculpta*; 197, *C. verdigripennis*; 198, *C. pusilla*; 199, *C. neopusilla*; 200, *C. nixa*; 201, *C. dentipes*; 202, *C. dolata*; 203, *C. blanchardi*; 204, *C. leechi*; 205, *C. orono*; 206, *C. columbiana*; 207, *C. scabripennis*; 208, *C. trinervia*; 209, *C. breviloba*; 210, *C. beeri*.

be renamed *C. insculpta* Herbst, the next oldest available name. Because of the economic importance of this species, and because of the great amount of literature references referring to *C. femorata*, I have decided not to change the name in this work. In order to conserve the name *femorata* for this species, however, an appeal must be directed to The International Commission on Zoological Nomenclature. I leave that task to someone else.

Chrysobothris semisculpta LeConte

Fig. 196

Chrysobothris semisculpta LeConte, 1860:254: Fisher 1942:83; Barr 1971:77.

Chrysobothris contigua LeConte, 1860:255; Chamberlin 1926:144; Fisher 1942:83.

Description. Body black, with a distinct coppery or brassy tinge, ventrally coppery, with a greenish tinge. Head bronzy brown, with faint coppery tinge, brilliant green along anterior margin of clypeus (♂) or uniformly coppery (♀), with obscure longitudinal carina on occiput; surface coarsely, densely, shallowly punctate, slightly, transversely rugose behind clypeus, sparsely clothed with long, semierect, whitish hairs. Clypeus narrowly, angularly notched at middle, with distinct acute tooth on each side, transversely sinuate externally. Antennae uniformly bronzy green (♂) or uniformly coppery (♀). Pronotum 2.0 times wider than long, widest near apex; sides strongly converging at apex, obliquely converging and slightly sinuate from near apex to posterior angles; disc uneven, slightly convex, with vague, longitudinal, median impression; surface coarsely, deeply, irregularly punctate, rugose laterally, interspaces feebly granulose. Elytra about 2.0 times longer than wide; sides parallel from humeral angles to apical third, then arcuately converging to broadly rounded tips; basal impressions broad, deep; humeral impressions broad, shallow; surface glabrous, coarsely, deeply, irregularly punctate with numerous, irregular, smooth spaces. Each elytron with distinct longitudinal costa along sutural margin, obsolete basally, other costae irregular and indistinct, and with 3 large, shallow, inconspicuous fovea, one at middle and two at apical third. Ventral surface sparsely, coarsely punctured, with few short, semierect, white hairs; last visible abdominal sternite semicircularly emarginate at apex, without a submarginal ridge (♂) or more narrowly, arcuately emarginate at apex (♀). Anterior tibiae strongly arcuate, with a broad tooth at apical third (♂) or unarmed (♀). Aedeagus as in Fig. 196. Length 7.5–12.0 mm.

Hosts. Recorded from ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*P. jeffreyi*), lodgepole pine (*P. contorta*), and sugar pine (*P. lambertiana*). Emerged from a dead limb on a live Douglas-fir (*Pseudotsugae menziesii*) (Nelson et al. 1981).

Distribution. California to Washington, east to Idaho; evidently not recorded from Canada but should occur in southern British Columbia.

Comments. Little variation is seen in adults of this species. The color and sculpture of the body are rather uniform but sometimes the pronotum is slightly more coppery or bronzy.

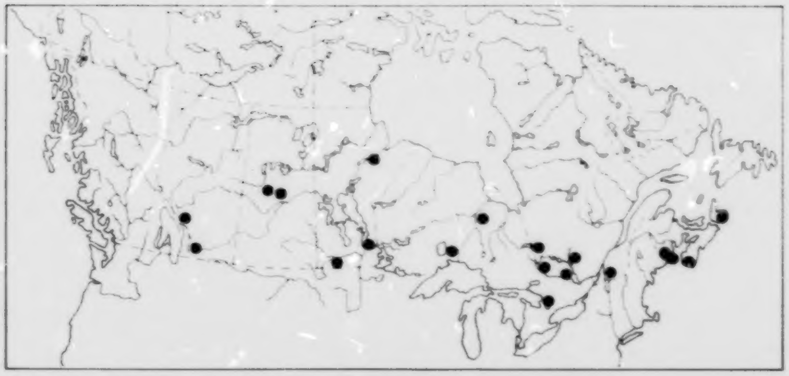
Nothing is known of the life history or biology of this species.

Chrysobothris verdigripennis Frost

Fig. 197; Map 46

Chrysobothris verdigripennis Frost, 1910:43; Knull 1925:30; Chamberlin 1926:176; Fisher 1942:141; Craighead 1950:195

Description. Body black, with vague purplish reflections on elevated spaces, bronzy green to coppery brown in impressed areas; ventrally purplish coppery to bronzy green with distinct coppery tinge. Head bright green to bronzy green, with 2 small, smooth callosities on frons and smooth, longitudinal carina on occiput; surface coarsely, deeply punctured, sparsely clothed with moderately long, semierect hairs. Clypeus deeply, broadly emarginate in front, subtruncate laterally. Antennae bronzy green basally. Pronotum about 2.0 times wider than long, widest along middle; sides sinuate, nearly parallel at middle, converging toward base and apex; disc convex, uneven, with broad, longitudinal, median impression, limited on each side on apical half by an irregular, elevated, smooth callosity, laterally with several of irregular, smooth, somewhat connected callosities; surface coarsely, deeply punctured between smooth callosities. Elytra about 1.7 times longer than wide; sides weakly diverging from humeral angles to behind middle, then arcuately converging to broadly rounded apices; basal impressions elongate,



Map 46. Collection localities of *Chrysobothris verdigripennis*.

deep; humeral impressions rounded, moderately deep; surface glabrous, densely, finely punctate in impressed areas. Each elytron with 4 vague to distinct longitudinal costae; first costa strongly elevated on apical half, interrupted basally; second and third costae reduced to short ridges and callosities, joined to each other and to first costa; fourth costa slightly indicated basally, following outline of lateral margin. Ventral surface densely, irregularly punctate, punctures confluent, forming crenulate ridges laterally, sparsely clothed with short, recumbent, white hairs; last visible abdominal sternite semicircularly emarginate at apex, without distinct submarginal ridge (♂) or narrowly, deeply emarginate at apex (♀). Anterior tibiae arcuate, with large triangular dilation at apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 197. Length 12.5–16.0 mm.

Hosts. Recorded from eastern hemlock (*Tsuga canadensis*), spruce (*Picea* spp.), pine (*Pinus* spp.), larch (*Larix* spp.), and balsam fir (*Abies balsamea*).

Distribution. Alberta to Nova Scotia, south through the northeastern United States.

Biology. Knull (1922) records this species working in scars and injuries on living hemlock, the larvae working beneath the bark and pupating in the sapwood.

Comments. Very little variation was observed in adults of this species except in color, which is mentioned in the description.

The coppery colored females of this species are difficult to distinguish from the females of *dentipes*; however, the males are easily distinguished by the dilation on the anterior tibiae of *verdigripennis*.

Chrysobothris pusilla Gory & Laporte

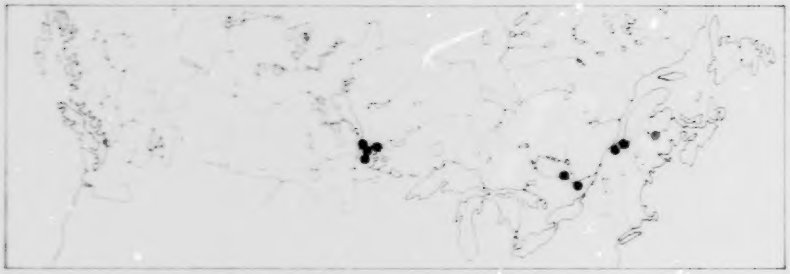
Fig. 198; Map 47

Chrysobothris pusilla Gory and Laporte 1841:53; Knull 1925:33; Chamberlin 1926:167; Fisher 1942:103; Craighead 1950:195.

Chrysobothris biguttata Laporte and Gory, 1841 (addenda):7; Fisher 1942:103.

Chrysobothris strangulata Melsheimer, 1845:147; Fisher 1942:104.

Description. Body dark bronzy brown, with impressions and punctures coppery or greenish; ventrally coppery brown with faint bronzy tinge. Head bronzy brown, becoming coppery brown on occiput, with 2 vague, smooth callosities on frons and narrow, smooth, longitudinal carina on occiput; surface coarsely, deeply, densely punctate, sparsely clothed with short, semierect hairs, interspaces densely granulose. Clypeus broadly, shallowly, arcuately emarginate in front, subtruncate laterally. Antennae bronzy brown. Pronotum 2.0 times wider than long, widest along middle; sides nearly parallel at middle, arcuately converging toward base and apex; disc slightly uneven,



Map 47. Collection localities of *Chrysobothris pusilla*.

with vague, longitudinal, median impression; surface coarsely, irregularly punctate, interspaces feebly granulose. Elytra about 2.0 times longer than wide, widest behind middle; sides slightly diverging from humeral angles to behind middle, then arcuately converging to narrowly rounded tips; basal impressions broad, deep; humeral impressions broad, shallow; surface glabrous, coarsely, densely, irregularly punctate, interspaces finely granulose. Each elytron with 4 distinct, longitudinal costae; first costa distinct from apex to basal third; second and third costae irregular, interrupted by vague foveae; fourth costa barely indicated, following outline of lateral margin. Ventral surface finely, irregularly punctate, sparsely clothed with short, recumbent, white hairs; last visible abdominal sternite broadly, deeply, arcuately emarginate at apex, without submarginal ridge (♂) or rounded or shallowly emarginate at apex (♀). Anterior tibiae arcuate, with small, rounded dilation at apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 198. Length 6.3–8.0 mm.

Hosts. Recorded from pine (*Pinus* spp.), larch (*Larix* spp.), eastern hemlock (*Tsuga canadensis*); possibly occurs in spruce (*Picea* spp.).

Distribution. Manitoba to New Brunswick, south through eastern United States to Virginia and Mississippi.

Comments. The color on the dorsal surface of the body is usually uniform, but it may be more coppery and the foveae on the elytra more greenish. The pronotum may be widest near the apex, with the sides strongly converging posteriorly and the median impression on the disc obsolete. The shape of the elytra also varies slightly. The foveae on the elytra may be more distinct and more strongly impressed in some specimens or the costae and foveae may be barely visible.

Nothing is known of the habits or life history of this species other than the hosts.

Chrysobothris neopusilla Fisher

Fig. 199; Map 48

Chrysobothris neopusilla Fisher, 1942:102.

Description. Similar to *pusilla* except head and antennae of male bright green and apex of last visible abdominal segment of the female deeply, arcuately emarginate. The aedeagus also differs (Fig. 199).

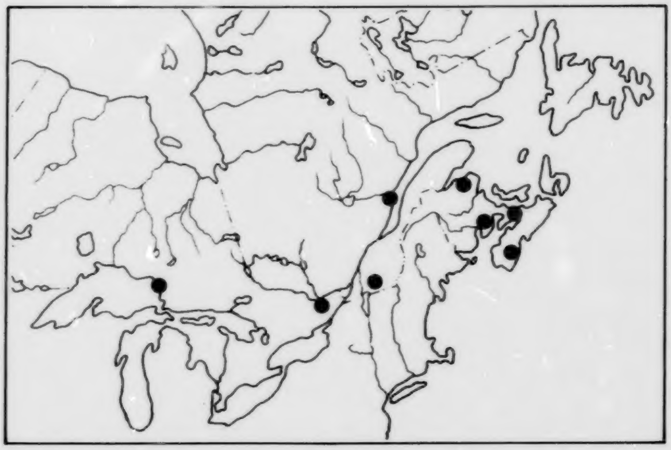
Hosts. Reared from black spruce (*Picea mariana*), white spruce (*P. glauca*), recorded from Fraser fir (*Abies fraseri*) in North Carolina.

Distribution. Manitoba (no exact locality) to Nova Scotia, south to Georgia.

Comments. Only a few specimens from Canada have been seen; therefore a discussion of variation is not feasible.

Nothing is known of the habits or biology of this species except for the hosts. The larvae have been described and illustrated by Benoit (1966*a*).

The Manitoba specimen of this species is labeled "Bear Riv. Rd.," a locality that could not be found in any gazetteer.



Map 48. Collection localities of *Chrysobothris neopusilla*.

Chrysobothris nixa Horn

Fig. 200

Chrysobothris nixa Horn, 1886:85, 98; Chamberlin 1926:164; Fisher 1942:156; Barr 1971:78.

Description. Body uniformly black, with faint coppery tinge; ventrally coppery brown, with distinct greenish and purplish reflections. Head coppery red to bronzy green (♂) or uniformly coppery brown (♀), with 2 small, obsolete callosities on frons and an indistinct longitudinal carina on occiput; surface finely, sparsely punctured, coarsely punctured on occiput; sparsely clothed with long, erect, white hairs. Clypeus broadly, shallowly, angularly emarginate in front, slightly rounded laterally. Antennae bronzy green basally, remainder brownish coppery (♂) or blackish with faint coppery or bronzy tinge (♀). Pronotum nearly 2.0 times wider than long, widest along middle; sides arcuately converging at base and apex, nearly parallel along middle; disc convex, with vague, longitudinal, median impression, vague transverse, postapical impression, and broad, inconspicuous depression on each side near lateral margin; surface coarsely, densely, deeply punctured, rugose laterally. Elytra nearly 2.0 times longer than wide; sides slightly diverging from humeral angles to behind middle, then arcuately converging to broadly rounded apices; basal impressions broad, deep; humeral impressions broad, shallow; surface glabrous, coarsely, densely punctured, transversely rugose at sides. Each elytron with 4 longitudinal costae; first costa strongly elevated from apex to basal third; second and third costae obsolete, broadly interrupted; fourth costa barely indicated, following outline of lateral margin. Ventral surface sparsely, coarsely punctate, sparsely clothed with short, erect hairs; last visible abdominal sternite deeply, semicircularly emarginate at apex (♂) or narrowly notched at apex (♀). Anterior tibiae arcuate, with broad, elongate dilation at apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 200. Length 9.0–14.5 mm.

Hosts. Recorded from incense cedar (*Libocedrus decurrens*), western juniper (*Juniperus occidentalis*), western red cedar (*Thuja plicata*), sargent cypress (*Cupressus sargentii*), and cypress (*Cupressus* spp.).

Distribution. Southern British Columbia to California, east to Wyoming.

Canadian record. Vancouver, Squamish, Wellington, and Wolfsohn [sic] Bay, B.C.

Comments. Little variation was observed in this species except in sculpture and color. The punctured areas may be more coppery red in some specimens. The pronotal impressions are variable in shape and occasionally there is a vague, smooth callosity on each side of the middle at the apical third.

This species differs from related species by occurring in cupressinae trees such as *Libocedrus*, *Thuja*, and *Juniperus*.

Nothing is known of the habits or life history of this species.

Chrysobothris dentipes (Germar)

Fig. 201; Map 49

Buprestis dentipes Germar, 1824:38.

Chrysobothris dentipes: Knull 1925:30; Chamberlin 1926:147; Fisher 1942:146; Craighead 1950:195; Barr 1971:78; Wellso et al. 1976:11.

Chrysobothris rotundicollis Gory and Laporte, 1841:51.

Chrysobothris posticalis Gory and Laporte, 1841:56.

Chrysobothris planata Gory and Laporte, 1841:56.

Description. Body black, with faint bronzy or coppery reflection, especially in impressions; ventrally purplish brown. Head coppery brown, frequently bright green anteriorly, with 2 small, smooth callosities on frons, and narrow, smooth, longitudinal carina on occiput; surface coarsely, deeply punctured, longitudinally rugose on vertex, sparsely clothed with moderately long, erect, white hairs. Clypeus broadly, deeply, triangularly emarginate in front, arcuately rounded laterally. Antennae bronzy green, segments 4–11 brownish yellow in part. Pronotum 2.0 times wider than long, widest at apical third; sides sinuate and slightly converging from apical third to posterior angles, arcuately converging at apical angles; disc slightly convex, with broad, deep, median sulcus, limited on each side by a broad, smooth, elevated space; surface uneven laterally, densely punctured in impressions, punctures coarser at sides. Elytra about 2.0 times longer than wide; sides nearly parallel from humeral angles to apical third, arcuately converging to broadly rounded apices; basal impressions broad, deep; humeral impressions broad, shallow; surface glabrous, uneven, finely, densely punctured between costae. Each elytron with first costa sinuate, distinct on apical half, obsolete basally; other costae replaced by broad, smooth spaces of irregular shape, and with vague, irregular, transversely oblique foveae behind middle. Ventral surface finely, irregularly punctate, slightly rugose laterally, sparsely clothed with short, inconspicuous hairs; last visible abdominal sternite broadly, deeply, arcuately emarginate at apex, without submarginal ridge (♂) or elongate, deeply, narrowly emarginate at apex (♀). Anterior tibiae arcuate, slightly dilated at apex (♂) or not dilated at apex (♀). Aedeagus as in Fig. 201. Length 12.0–18.0 mm.

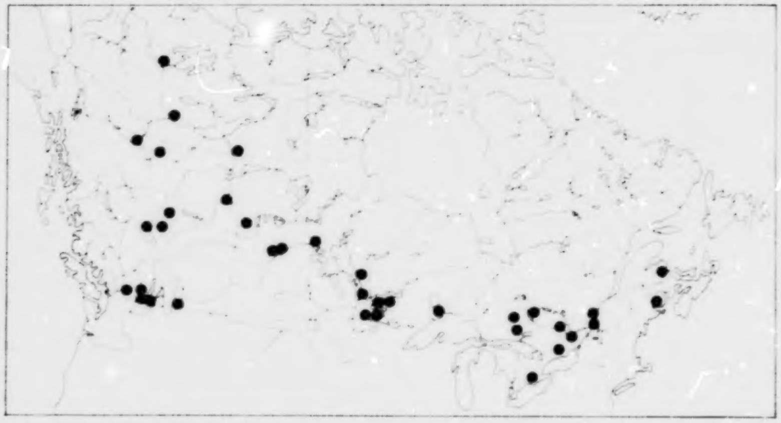
Hosts. Known from pine (*Pinus* spp.), larch (*Larix* spp.), fir (*Abies* spp.), and spruce (*Picea* spp.).

Distribution. Transcontinental in North America; also in West Indies and northern Mexico.

Comments. Little variation has been noted in adults of this species despite its wide distribution.

The larvae are described by Benoit (1964).

Nothing is known of the habits or life history of this species.



Map 49. Collection localities of *Chrysobothris dentipes*.

Chrysobothris dolata Horn

Fig. 202

Chrysobothris dolata Horn, 1886:85; Chamberlin 1926:149; Fisher 1942:148; Barr 1971:78.

Description. Body uniformly black, with a vague bronzy tinge; ventrally purplish black to reddish purple. Head purplish black, with 2 small, smooth callosities on frons and a narrow, smooth, longitudinal carina on occiput; surface coarsely, deeply punctured, transversely rugose anteriorly, densely clothed with long, erect, white hairs. Clypeus broadly, deeply, arcuately emarginate in front, arcuately rounded laterally. Antennae purplish coppery. Pronotum 2.0 times wider than long, widest near apex; sides strongly, arcuately converging at apex, then slightly, obliquely converging from near apex to posterior angles; disc strongly depressed, with 1 or 2 large, irregular impressions on each side of middle, and broad, elongate impression on each side near lateral margin; surface glabrous, impressed areas subopaque, densely, finely scabrous, rugose basally. Elytra about 1.8 times longer than wide; sides nearly parallel from humeral angles to apical third, then arcuately converging to narrowly rounded apices; basal and humeral impressions united; surface glabrous, uneven; impressed areas subopaque, densely, finely scabrous, more or less rugose basally. Each elytron with 4 longitudinal costae; first costa strongly elevated posteriorly, extending from base to apex; second and third costae broadly interrupted, usually joined to each other by irregular, elevated, smooth spaces; fourth costa slightly elevated, following outline of lateral margin. Ventral surface densely, irregularly punctate, more so laterally, sparsely clothed with short, recumbent hairs; last visible abdominal sternite deeply, semicircularly emarginate at apex (♂) or with narrow rectangular or acute notch at apex (♀). Anterior tibiae arcuate, with narrow, rounded dilation near apex (♂) or not dilated at apex (♀). Aedeagus as in Fig. 202. Length 10.5–14.5 mm.

Hosts. Recorded from white fir (*Abies concolor*), pine (*Pinus* spp.), and Douglas-fir (*Pseudotsuga menziesii*).

Distribution. California to Washington, east to northern Idaho; not yet recorded from Canada but should occur in southern British Columbia.

Comments. Adults of this species are quite uniform in appearance, and no variation worthy of note was observed.

The larvae have been described and illustrated by Benoit (1966*a*).

Nothing is known of the habits or life history of this species.

Chrysobothris grandis Chamberlin

Chrysobothris grandis Chamberlin, 1938:14; Fisher 1942:155; Barr 1971:79, 81.

Description. Body black on elevated smooth spaces, purplish to bluish in impressed, punctured areas; ventrally purplish brown. Head greenish to greenish golden (♂) or purplish brown (♀), with 2 small, smooth callosities on frons and a narrow, smooth, longitudinal carina on occiput; surface coarsely, shallowly punctate, sparsely clothed with short, erect, white hairs. Clypeus broadly, shallowly emarginate in front, subtruncate laterally. Antennae greenish on basal three segments, segments 4–11 purplish, 4 and 5 partly greenish (♂) or uniformly purplish brown (♀). Pronotum about 2.0 times wider than long, widest along middle; sides arcuately converging at base and apex, parallel and sinuate at middle; disc slightly convex, uneven, with a shallow, longitudinal, median impression, limited on each side by a smooth or punctured, elevated space, and with round, elevated, smooth callosity on each side at base; surface densely, finely punctured in impressed areas, reticulate toward sides. Elytra about 2.0 times longer than wide; sides nearly parallel from humeral angles to behind middle, arcuately converging to broadly rounded apices; basal and humeral impressions broad, deep; surface glabrous, finely, densely punctate between elevated, smooth spaces. Each elytron with 3 smooth costae; first costa strongly elevated from base to apex; second and third costae broadly interrupted, sometimes joined to each other and to first costa by irregular, smooth spaces. Ventral surface sparsely, finely punctured, sparsely clothed with short, semierect, white hairs; last visible abdominal sternite deeply, semicircularly emarginate at apex (♂) or angulately emarginate at apex (♀). Anterior tibiae arcuate, with broad dilation at apex (♂) or unarmed at apex (♀). Length 11.0–17.0 mm.

Hosts. Recorded only from pine (*Pinus* spp.).

Distribution. Southern British Columbia to California, east to Idaho.

Comments. Only a few specimens of this species have been seen. No variation worthy of note was observed.

Nothing is known of the habits or biology of this species.

Chrysobothris neotexana Dozier

Chrysobothris neotexana Dozier, 1955:75.

Description. Head and pronotum black with coppery reflections, more so on head; elytra black with greenish reflections; ventrally black. Head black with strong reddish coppery reflections, with 2 small callosities in middle and a smooth, longitudinal carina on occiput, bearing prominent longitudinal groove; surface strongly punctured, punctures broad and shallow, densely clothed with long hairs. Clypeus shallowly, broadly emarginate. Antennae black; first segment as long as following two united, segments subtruncate, beginning with fourth segment. Pronotum 1.6 times wider than long, widest anteriorly; disc moderately convex, with vague impression on each side near lateral margins; surface moderately punctured, becoming confluently punctate near lateral margins, punctures broad, shallow. Elytra 1.8 times longer than wide; sides nearly parallel, posterior third arcuately converging to broadly rounded apices; basal and humeral impressions broad and deep; surface glabrous, strongly punctured between costae. Each elytron with 4 longitudinal costae; first costa extending from base to apex, strongly elevated on posterior half; second costa joining fourth costa near apex, strongly interrupted; third costa extending from humerus, converging to meet second costa, interrupted near middle; fourth costa extending from humerus to apex along lateral margins of elytra. Ventral surface densely punctate, moderately clothed with long hairs; last visible abdominal sternite broadly, shallowly emarginate with serrate submarginal ridge (♂) or more narrowly notched (♀). Length 7.4–9.1 mm.

Hosts. Eastern red cedar (*Juniperus virginiana*).

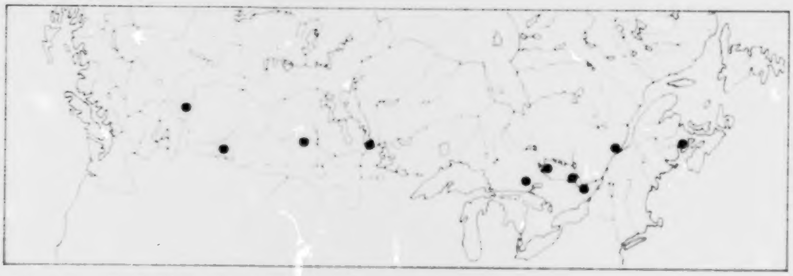
Distribution. Recorded from North Carolina and Michigan. Not recorded from Canada but may occur in southern Ontario.

Comments. This species is included here based on information supplied by Dr. G. H. Nelson (pers. comm. 1983). No specimens have been seen. The foregoing description is taken from the original description. Nothing is known of the habits or life history of this species.

Chrysobothris blanchardi Horn

Fig. 203; Map 50

Chrysobothris blanchardi **Horn, 1886:85, 93; Knull 1925:32; Chamberlin 1926:140; Fisher 1942:163; Barr 1971:80, 91.**



Map 50. Collection localities of *Chrysobothris blanchardi*.

Description. Body black, strongly shining on elevated spaces, bronzy coppery in impressed areas; ventrally purplish brown with bronzy green reflection. Head bright green to bronzy green, coppery on occupit, with 2 small, round callosities on front and a broad, smooth, longitudinal reflection on occupit; surface coarsely, confluently punctured, sparsely clothed with long, erect, inconspicuous hairs. Clypeus broadly, deeply, angularly emarginate in front, broadly rounded laterally. Antennae bright bronzy green. Pronotum about 2.0 times wider than long, widest near apical fourth; sides strongly, arcuately converging near apical angles, subparallel at middle, arcuately converging posteriorly; disc slightly convex, with obscure, broad, densely punctured, median sulcus, limited on each side by a slightly elevated, less densely punctured space and with somewhat distinct, oblique, sparsely punctured space laterally; surface coarsely, deeply punctured. Elytra about 2.0 times longer than wide; sides nearly parallel from humeral angles to apical third, then arcuately converging to broadly rounded apices; basal impressions broad, deep; humeral impressions broad, shallow; surface glabrous, coarsely, densely, irregularly punctate in impressions. Each elytron with 3 more or less distinct, longitudinal costae; first costa strongly elevated from apex to before middle, extending as smooth space to base; second and third costae interrupted, forming irregular, narrow, smooth spaces, an irregular, densely punctured fovea at middle third between first and third costae, and a smaller one near middle interrupting second costa. Ventral surface finely, sparsely punctured, sparsely clothed with short, semierect, inconspicuous hairs; last visible abdominal sternite deeply, arcuately emarginate at apex (♂) or deeply, narrowly notched at apex (♀). Anterior tibiae strongly arcuate, strongly dilated on apical third (♂) or unarmed at apex (♀). Aedeagus as in Fig. 203. Length 10.0–13.5 mm.

Hosts. Reared from pitch pine (*Pinus rigida*), eastern white pine (*P. strobus*), Virginia pine (*P. virginiana*), and tamarack (*Larix laricina*).

Distribution. Alberta to New Brunswick, south to Arizona, Texas, and Florida.

Comments. Adults of this species show little variation in color. Minor variations in sculpture or body shape have been noted but are not sufficient for special comments.

Barr (1971) records this species from southeastern British Columbia based on a single specimen from Creston identified by W. J. Chamberlin. He further states that the specimen should, perhaps, be more properly assigned to *columbiana* Barr.

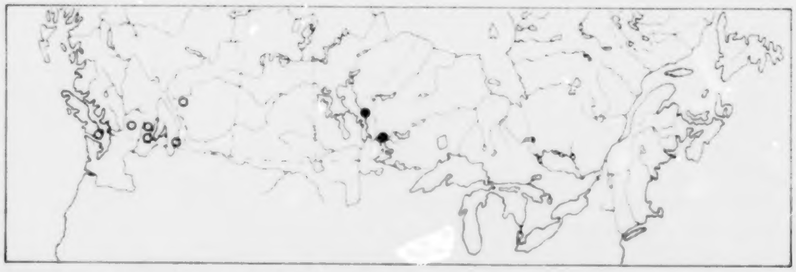
Nothing is known of the habits or life history of this species.

Chrysobothris leechi Barr

Figs. 38, 50, 57, 204; Map 51

Chrysobothris leechi Barr, 1974:3.

Description. Body dark coppery, shining; ventrally purplish with brassy reflection. Head greenish, with yellowish tinge on upper middle, darker on occiput, with broad, longitudinal median carina on occiput and 2 small callosities at middle; surface densely foveolate-punctate, densely clothed with short, recumbent, white setae. Clypeus broadly, deeply emarginate at middle, obliquely subtruncate laterally. Antennae green. Pronotum 1.7 times wider than long, widest behind anterior angles; sides feebly sinuate, broadly rounded behind anterior angles, angulate behind middle; disc slightly convex, with broad, shallow, median sulcus, callosities on each side elongate, sparsely punctured; surface densely, coarsely punctured, more so laterally. Elytra about 2.0 times longer than wide; sides subparallel from humerus to middle, arcuately converging to narrowly rounded apices; basal and humeral impressions shallow; surface densely, closely punctured, glabrous. Each elytron with 4 more or less indistinct longitudinal costae; first costa entire, nearly straight, extending from basal fourth to apex; second, third, and fourth costae evident only as feebly elevated ridges between elevated callosities. Ventral surface finely, sparsely punctured, sparsely clothed with short, semierect,



Map 51. Collection localities of *Chrysobothris leechi* (○) and *C. orono* (●).

white setae; last visible abdominal sternite broadly, nearly semicircularly emarginate at apex (♂) or with small emargination at apex (♀). Anterior tibiae strongly arcuate, dilation abruptly narrowed at apex (♂) or slightly arcuate and unarmed at apex (♀). Aedeagus as in Fig. 204. Length 10.0–13.0 mm.

Hosts. Recorded from pine (*Pinus* spp.) and probably occurs in other conifers in its range.

Distribution. Southern British Columbia and western Alberta to southern California, east to western Montana.

Comments. This is a relatively unknown species that has only recently been recognized and described. It is the species usually referred to as *caurina* in the literature. Horn (1886) described *caurina* from a mixed series of *leechi* and *caurina*. Fisher (1942) continued the error in his revision of the genus by describing the lectotype of *caurina* but figuring the aedeagus and male protibia of *leechi*. Barr (1974) states that *caurina* resembles most closely the recently described *beeri*, whereas *leechi* resembles *falli* Van Dyke and *grandis*.

Nothing is known of the habits or life history of this species.

Chrysobothris orono Frost

Fig. 205; Map 51

Chrysobothris orono Frost, 1920:232; Chamberlin 1926:165; Fisher 1942:172; Baker 1972:166.

Description. Body black, with faint purplish reflection on elevated, smooth spaces, bronzy green, coppery or greenish in depressed, punctured areas, strongly shining; ventrally purplish coppery, with vague bronzy reflection, greenish in certain areas. Head bronzy green (♂) or purplish brown (♀), with narrow, smooth, longitudinal carina on occiput and a pair of small, smooth callosities on frons; surface finely densely punctate, sparsely clothed with long, erect, inconspicuous hairs. Clypeus broadly, deeply, arcuately emarginate in front, arcuately rounded laterally. Antennae bright green (♂) or bronzy brown (♀). Pronotum about 2.0 times wider than long, widest near base; sides arcuately converging at apical angles, slightly sinuate, nearly parallel from near apical angles to near posterior angles; disc moderately convex, with broad, longitudinal, median impression, limited laterally on apical half by broad, smooth callosity, and with short, sinuate callosity located halfway toward lateral margin; surface densely, finely punctate, more coarsely laterally. Elytra about 2.0 times longer than wide; sides slightly diverging from humeral angles to behind middle, arcuately converging to broadly rounded apices; basal impressions broad, deep; humeral impressions broad, shallow; surface glabrous. Each elytron with first costa strongly elevated from basal fourth to apex, other costae replaced by short, smooth lines and smooth, irregular, transverse spaces, alternating with finely, densely punctured areas. Ventral surface densely, irregularly, shallowly punctate, sparsely clothed with short, recumbent hairs; last visible abdominal sternite broadly, semicircularly emarginate at apex (♂) or more shallowly emarginate at apex (♀). Anterior tibiae strongly arcuate, with broad dilation at apex (♂) or tibiae slightly arcuate, unarmed at apex (♀). Aedeagus as in Fig. 205. Length 14.0 mm.

Hosts. Unknown.

Distribution. Manitoba and Ontario but probably occurs at least to New Brunswick and Nova Scotia; also Maine, Michigan to North Carolina, and Tennesee.

Comments. Only two specimens of this uncommon species have been seen. Scarcely any variation was observed.

Very little is known of the habits or life history of this species. Eggs are laid singly on the bark. The larvae feed in the bark during the first three instars, excavating cells and causing flowing pitch to coagulate into large pitch masses. Older larvae feed in the wood. The winter is spent in the larval stage. In the spring of the 3rd year, the larvae construct L-shaped cells, plugged with wood chips and frass, where pupation occurs. This species is seldom injurious, although injury may remain in the bole as a defect after the wounds have healed (Baker 1972).

Chrysobothris columbiana Barr

Fig. 206

Chrysobothris columbiana Barr, 1969*b*:131; Barr 1971:80, 81.

Description. Body black, elytra purplish brown in impressed and densely punctured areas, shining; ventrally with coppery and bluish reflections. Head with a faint bluish cast in small impressed areas on each side of middle, with broad, conspicuous, longitudinal median carina on vertex and pair of smooth, somewhat transverse, inconspicuous callosities on frons; surface coarsely, densely punctate, densely clothed with short, subdepressed, white hairs. Clypeus broadly, deeply, triangularly emarginate in front, subtruncate laterally. Antennae blackish. Pronotum 1.5 times wider than long, widest at middle; sides broadly arcuate, subparallel at middle; disc convex, with narrow, longitudinal, median sulcus and a pair of irregular, longitudinal callosities on either side, several small, irregular callosities located laterally; surface densely, coarsely, punctured in median depression, irregularly punctate between callosities. Elytra 1.75 times longer than wide; sides subparallel from basal fourth to behind middle, arcuately converging to narrowly rounded apices; basal and humeral impressions shallow; surface densely, coarsely punctured between smooth spaces. Each elytron with 3 longitudinal costae; first costa indistinct on basal half, distinct apically; second and third costae indistinct, interrupted. Ventral surface finely, shallowly punctured; last visible abdominal sternite thickened apically, broadly, deeply, arcuately emarginate at apex (♂) or slightly notched at apex (♀). Anterior tibiae strongly arcuate, with weakly developed, elongate dilation at apex (♂) or without dilation at apex (♀). Aedeagus as in Fig. 206. Length 11.0–14.0 mm.

Hosts. Recorded from ponderosa pine (*Pinus ponderosa*) and lodgepole pine (*P. contorta*).

Distribution. Southern British Columbia to eastern Washington.

Canadian records. Midday Creek, Merritt, B.C. (Barr 1969*b*).

Comments. This recently described species is little known. It apparently is related to *blanchardi* but runs to *trinervia* in Fisher's (1942) key. Adults of *columbiana* may be distinguished from *blanchardi* and *trinervia* by the distribution, by the conspicuous sublateral elevation on the last visible abdominal sternite, and by the more weakly developed elytral striae.

Nothing is known of the habits and biology of this species.

Chrysobothris vulcanica LeConte

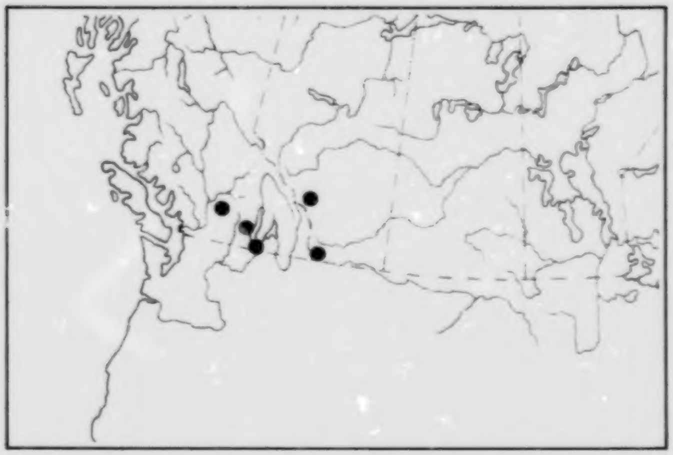
Map 52

Chrysobothris vulcanica LeConte, 1861:346; Fisher 1942:169; Barr 1971:80, 81.

Chrysobothris canadensis Chamberlin, 1934:37.

Description. Body brownish black, with faint purplish reflection on elevated, smooth spaces, coppery to bronzy green in depressions; ventrally purplish brown, with a distinct bronzy green reflection in certain lights. Head bronzy green (♂) or purplish brown (♀), with broad, short, longitudinal carina on occiput, and 2 small, smooth callosities on frons; surface coarsely, deeply punctate, densely clothed with moderately long, erect, inconspicuous hairs. Clypeus broadly, deeply, angularly emarginate in front, obliquely subtruncate laterally. Antennae bronzy green (♂) or purplish brown (♀). Pronotum about 2.0 times wider than long, widest along middle; sides parallel at middle, arcuately converging at base and apex; disc slightly convex, longitudinal, median sulcus extending from base to apex, 2 broad, irregular impressions on each side, one near anterior margin and the other near base, and with numerous, small, irregular, smooth spaces; surface coarsely, deeply punctate between smooth elevations. Elytra about 2.0 times longer than wide; sides sinuate and slightly diverging from humeral angles to behind middle, arcuately converging to broadly rounded apices; basal impressions broad, very deep; humeral impressions broad, shallow; surface glabrous, densely, irregularly punctate between smooth elevations. Each elytron with first costa sinuate, strongly elevated from apex to basal third, other costae broadly interrupted, represented by irregular, narrow, smooth spaces. Ventral surface coarsely, densely, irregularly punctate, clothed with a few short, recumbent, inconspicuous setae; last visible abdominal sternite deeply, broadly, arcuately emarginate at apex (♂) or with small, semicircular notch at apex (♀). Anterior tibiae arcuate, with rounded dilation at apex (♂) or unarmed at apex (♀). Length 15.0–17.0 mm.

Hosts. Unknown.



Map 52. Collection localities of *Chrysobothris volcanica.*

Distribution. Southern British Columbia and Alberta, south to California and Wyoming.

Comments. Only a few specimens of this species are known. Nothing is known of its habits or biology.

Fisher (1942) records very little variation in the few specimens he examined. The color in the impressed areas on the dorsal surface of the body varies from bronzy green to coppery and the smooth callosities on the front of the head are occasionally absent.

Horn (1886) placed this species in synonymy under *californica*, stating that it was just a smaller form. Fisher (1942) states that *vulcanica* is distinct from *californica* and reestablished its specific status. I follow Fisher (1942).

Chrysobothris scabripennis Gory & Laporte

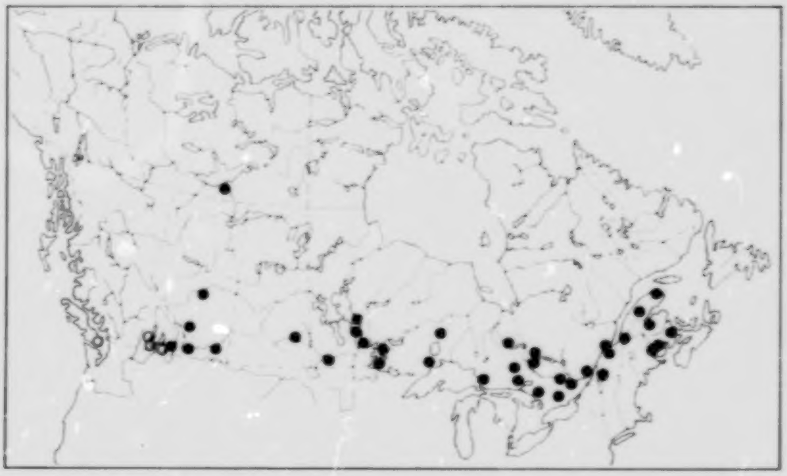
Fig. 207; Map 53

Chrysobothris scabripennis Gory and Laporte, 1841:53; Knull 1925:31; Chamberlin 1926:169; Fisher 1942:175; Craighead 1950:195; Barr 1971:78, 80.

Buprestis proxima Kirby, 1837:157.

Chrysobothris scabra Gory, 1941:182.

Description. Body black on elevated spaces, bronzy green, with slight coppery tinge in impressed areas; ventrally purplish brown, bronzy green on legs. Head bright green (♂) or coppery brown (♀), with pair of small, smooth callosities on frons, and broad, smooth, longitudinal carina on occiput; surface finely, confluently punctate, densely clothed with long, erect, inconspicuous hairs. Clypeus broadly, deeply, angularly emarginate in front,



Map 53. Collection localities of *Chrysobothris scabripennis* (●) and *C. caurina* (○).

broadly rounded laterally. Antennae green (♂) or bronzy green to brownish cupreous (♀). Pronotum about 2.0 times wider than long, widest near apex; sides abruptly converging at apical angles, slightly converging from near apical angles to posterior angles; disc slightly convex, with broad, shallow, longitudinal, median impression, limited laterally by slightly elevated, irregular, smooth space, between which and lateral margin are several transverse, smooth folds; surface between elevations densely, finely, irregularly punctate. Elytra about 2.0 times longer than wide; sides nearly parallel from humeral angles to apical third, arcuately converging to narrowly rounded apices; basal and humeral depressions broad, shallow; surface glabrous, uneven, finely, densely, irregularly punctured between elevated, smooth spaces. Each elytron with 4 more or less distinct, smooth costae, these interrupted and irregularly connected to one another by transverse, elevated, smooth lines. Ventral surface coarsely, irregularly, sparsely punctured, sparsely clothed with short, recumbent white hairs; last visible abdominal sternite deeply, arcuately emarginate at apex (♂) or more broadly, arcuately emarginate at apex (♀). Anterior tibiae strongly arcuate, with long, rounded dilation at apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 207. Length 9.0–13.0 mm.

Hosts. Recorded from pine (*Pinus* spp.), eastern hemlock (*Tsuga canadensis*), and spruce (*Picea* spp.). Birch (*Betula* spp.) is also a recorded host but this needs verification.

Distribution. Northwest Territories and southeastern British Columbia to New Brunswick, south to West Virginia in the east, and Oregon and Colorado in the west; however, the records from the far west may refer to another species.

Comments. Some variation can be observed in the adults. The color in the impressions on the dorsal surface of the body varies from coppery red to bright bronzy green, and on the front of the head in the male from bright to bronzy green. The sides of the pronotum may be slightly sinuate and nearly parallel at the middle, with two or three impressions on each side between the median sulcus and the lateral margin. The ventral surface of some specimens has a distinct bronzy green reflection.

As noted in the synonymy, *proxima* (Kirby 1837) appears to have priority over *scabripennis* (Gory 1841). An examination of the pertinent literature shows this to be so. All previous authors (Chamberlin, Fisher, Obenberger, and Saunders) have considered the actual date of availability of *scabripennis* to be 1837, the date shown on the plate on which *scabripennis* is illustrated. However, most of the plates in the book are undated, and some are dated 1836, 1837, or 1838. It is my contention that 1837 is the date when the printer prepared the plate, which was subsequently bound into the book by the publisher and printed in 1841, along with the original description. Obenberger (1934) gives the 1837 date for species regardless of the date or lack of date on the plate on which the species illustration occurs. Although the International Code of Zoological Nomenclature, Article 16 (a) (vii), might be argued to apply in this instance, a great amount of confusion would result. Since I have not seen the types of *proxima* or of *scabripennis*, the synonymy cannot be confirmed, but if the two are synonymous, *proxima* is the proper name for this species. In the interest of stability and in conformity with current usage, I am using *scabripennis* in this work.*

The larvae are described in Benoit (1964).

Nothing is recorded concerning the habits or biology of this species.

Chrysobothris caurina Horn

Map 53

Chrysobothris caurina Horn, 1886:85, 92; Chamberlin 1926:142; Fisher 1942:161; Barr 1971:79, 82; Furniss and Carolin 1977:260.

Description. Body uniformly black, with vague purplish reflection, strongly shining; ventrally purplish coppery, with bronzy tinge. Head bronzy green in front, black on occiput (♂) or uniformly coppery brown (♀), with smooth, longitudinal carina on occiput and 2 small callosities on frons; surface densely punctate, sparsely clothed with long, erect, inconspicuous hairs. Clypeus broadly, rather deeply, angularly emarginate in front, arcuately rounded laterally. Antennae bronzy green (♂) or brownish coppery (♀). Pronotum about 2.0 times wider than long, widest about middle; sides parallel, sinuate along middle, arcuately converging near base and apex; disc moderately convex, with broad, shallow, median sulcus and several irregular, smooth callosities; surface densely punctured in median sulcus, irregularly punctured on each side. Elytra about 2.0 times longer than wide; sides nearly parallel from humeral angles to apical third, then arcuately converging to broadly rounded apices; lateral margins coarsely serrate; basal and humeral impressions broad, shallow; surface glabrous, with finely, densely punctured, irregular-shaped spaces, and broad, smooth spaces and with reticulating lines laterally. Each elytron with 4 more or less longitudinal costae; first costa distinct, extending from near base to apex; second and third costae indistinct and somewhat interrupted; fourth costa reduced to fine line following outline of lateral margin. Ventral surface finely, sparsely punctured, sparsely clothed with short, semierect, white setae; last visible abdominal sternite deeply, semicircularly emarginate at apex (♂) or with small emargination at apex (♀). Anterior tibiae strongly arcuate, with broad dilation at apex and deep notch behind dilation (♂) or slightly arcuate and unarmed at apex (♀). Length 10.0–13.0 mm.

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* Dr. G. H. Nelson (pers. comm. 1983) states that the fascicle in which *scabripennis* appears was issued in 1837; therefore the previous discussion may be unnecessary. He is preparing a paper on the dates of the Laporte and Gory monograph.

Hosts. Recorded from sugar pine (*Pinus lambertiana*), ponderosa pine (*P. ponderosa*), Jeffrey pine (*P. jeffreyi*), mountain hemlock (*Tsuga mertensiana*), white fir (*Abies concolor*), western larch (*Larix occidentalis*), and Douglas-fir (*Pseudotsuga menziesii*). Probably occurs in most conifers in its range.

Distribution. Southern British Columbia to Arizona, east to Colorado and Wyoming.

Comments. Adults of this species show little variation in color and sculpture of the body. Minor variations in pronotal shape, depth of emargination of the clypeus, and the emargination at the apex of the last visible abdominal sternite can be noted.

Nothing is known of the habits or biology of this species.

Chrysobothris trinervia (Kirby)

Figs. 27, 208; Map 54

Buprestis trinervia Kirby, 1837:157.

Chrysobothris trinervia: Knull 1925:31; Chamberlin 1926:174; Fisher 1942:178; Craighead 1950:195; Barr 1971:78, 81; Furniss and Carolin 1977:260.

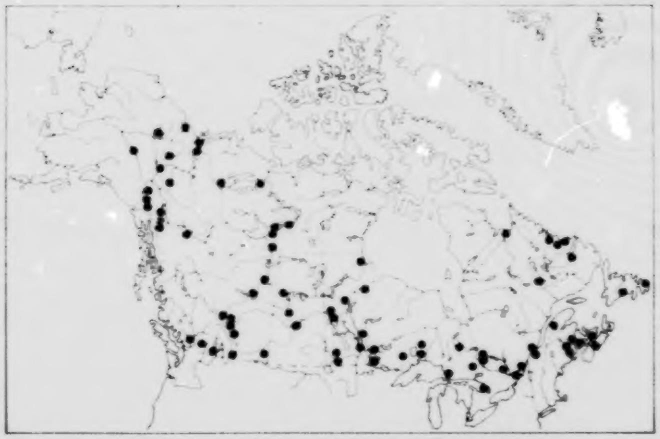
Chrysobothris cicatricosa Motschulsky, 1852:77.

Description. Body black on elevated spaces, bronzy green, with faint coppery tinge in impressed areas; ventrally purplish brown with faint greenish reflection. Head bronzy green (♂) or purplish coppery (♀), with broad, smooth, longitudinal carina on occiput, and a pair of smooth, irregular callosities on frons; surface coarsely, irregularly punctate, sparsely clothed with long, erect, inconspicuous hairs. Clypeus broadly, deeply, angularly emarginate in front, arcuately rounded laterally. Antennae bronzy green (♂) or coppery with slight bronzy green tinge (♀). Pronotum about 2.0 times wider than long, widest near apex; sides abruptly converging at apex, slightly sinuate, weakly converging from near apical angles to posterior angles; disc convex, with broad, longitudinal, median impression, limited on each side by a smooth, irregular elevation, with rounded impression on each side at apical fourth, and with numerous, irregular callosities or rugae on each side near lateral margin; surface between elevations coarsely, irregularly punctate. Elytra about 2.0 times longer than wide; sides feebly diverging from humeral angles to behind middle, then arcuately converging to narrowly rounded apices; basal and humeral impressions broad, deep; surface glabrous, uneven finely, densely, irregularly punctate between the elevated, smooth spaces. Each elytron with 4 longitudinal costae; first costa distinct; second and third costae indistinct, interrupted; fourth costa barely indicated, sinuate, following outline of lateral margin; interspaces between costae with alternating densely punctured areas and irregular, smooth, elevated spaces. Ventral surface finely to coarsely, densely punctate, sparsely clothed with short, semierect, white hairs; last visible abdominal sternite broadly, semicircularly emarginate at apex (♂) or with small, semicircular emargination at apex (♀). Anterior tibiae strongly arcuate, with broad, sinuate dilation at apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 208. Length 10.0–13.6 mm.

Hosts. Recorded from pine (*Pinus* spp.), spruce (*Picea* spp.), and Douglas-fir (*Pseudotsuga menziesii*).

Distribution. Alaska, across Canada, and extending south at least to Colorado and Utah in the west and to North Carolina in the east.

Comments. This is a commonly encountered species in Canada; however, nothing is known of its habits or life history.



Map 54. Collection localities of *Chrysobothris trinervia*.

Variations occur mainly in the colors of the body surface that range from purplish coppery to bronzy green in the impressed punctured areas, and on the head of the male from bright green to bronzy green with a coppery reflection. The shape of the pronotum and elytra also varies slightly, as well as the elytral sculpturing.

The larvae have been described by Benoit (1964).

Chrysobothris breviloba Fall

Fig. 209

Chrysobothris breviloba Fall, 1910:51; Chamberlin 1926:140; Fisher 1942:182.

Description. Body black on elevated spaces, coppery in impressed areas; ventrally black, with purplish and greenish reflections. Head yellowish green (♂) or coppery brown (♀), with distinct, smooth, longitudinal carina on occiput; surface coarsely, deeply punctate, densely clothed with long, erect, inconspicuous hairs. Clypeus broadly, deeply, arcuately emarginate in front, obliquely subtruncate laterally. Antennae coppery, greenish on basal segments. Pronotum 0.75 times wider than long, widest near apex; sides strongly converging at apex, obliquely converging from near apical angles to posterior angles; disc slightly convex, very uneven, with numerous well-defined, smooth callosities and a vague, longitudinal, median impression; surface densely, coarsely, irregularly punctate between smooth callosities. Elytra about 2.0 times longer than wide; sides nearly parallel from humeral angles to behind middle, then arcuately converging to broadly rounded apices; basal impressions broad, deep; humeral impressions broad, shallow; surface glabrous, uneven, with numerous small, irregular, smooth spaces, between which surface is densely, rather finely punctate. Each elytron with 4 longitudinal costae; first costa distinct, narrow, strongly elevated apically; second, third, and fourth costae less distinct, sinuate, interrupted by numerous impressed punctured areas and smooth, elevated spaces. Ventral surface sparsely, coarsely punctured, sparsely clothed with short, recumbent, white hairs; last visible abdominal sternite deeply, arcuately emarginate at apex (♂) or with small, narrow triangular notch at apex (♀). Anterior tibiae strongly arcuate, with short dilation at apex, deeply constricted behind dilation (♂) or unarmed at apex (♀). Aedeagus as in Fig. 209. Length 8.5–12.0 mm.

Hosts. Known from pine (*Pinus* spp.) and Douglas-fir (*Pseudotsuga menziesii*).

Distribution. Alberta (?), British Columbia (?), south through the western United States.

Comments. The Canadian records of this species need to be verified. Fisher (1942) had specimens only from the western United States, but the species is recorded from Alberta and British Columbia by Gibson (1917) (Banff, Alta.; Peachland, B.C.). Since Gibson's specimens have not been located, the identification cannot be verified. Barr (1969*b*) states that *C. breviloba* occurs in the central Rocky Mountains and does not occur in the Pacific Northwest.

The sculpture on the dorsal surface of the body is rather uniform but the color in the impressed areas varies from bronzy green to purplish coppery. Other variations are only very slight.

Nothing is known of the habits or biology of this species.

Chrysobothris beeri Barr

Fig. 210

Chrysobothris beeri Barr, 1969*b*:128; Barr 1971:79, 81.

Description. Body blackish with coppery and faint greenish reflections in punctured areas; ventrally prosternum and mesosterna green, metasternum and abdomen purplish. Head green (♂) or coppery (♀), with broad, feebly developed, longitudinal, median carina on occiput and pair of elongate callosities on frons; surface finely, densely punctured, densely clothed with short, recumbent, white hairs. Clypeus broadly, deeply triangularly emarginate at middle, broadly rounded laterally. Antennae green. Pronotum 1.75 times wider than long, widest on anterior portion; sides subparallel, broadly rounded at front, obtuse at hind angles; disc convex, with narrow, longitudinal, median impression limited on each side by pair of irregular, longitudinal callosities that join at base, small, distinct impression located behind anterior margin lateral of median callosities, and slight impression located along sides at middle; surface finely, densely punctured. Elytra 1.75 times longer than wide; sides broadly but weakly sinuate from humeral angle to behind middle, then gradually arcuate to narrowly rounded apices; basal and humeral impressions small; surface with large, irregular, somewhat broken, smooth callosities at basal fourth, at middle, and at apical third, intervening areas finely, densely punctured. Each elytron with 4 longitudinal costae; first costa moderately elevated, joining 3 large callosities; second and third costae weakly elevated, interrupted at middle, evident on basal half and apical half where it joins first costa to form a "Y"; fourth costa weakly elevated. Ventral surface sparsely, shallowly punctured; last visible abdominal sternite broadly, nearly semicircularly emarginate at apex (♂) or subtruncate, with small, angulate lobe at middle (♀). Anterior tibiae strongly arcuate, abruptly expanded at apex (♂) or unarmed at apex (♀). Aedeagus as in Fig. 210. Length 9.0–12.0 mm.

Hosts. Not recorded but probably occurs in pine (*Pinus* spp.).

Distribution. Southern British Columbia to Oregon.

Canadian record. Blackwall, Manning Park, B.C. (Barr 1969*b*).

Comments. Adults of this species are most easily distinguished from those of similar species such as *sylvania* and *laricis* by the sutural and discal elytral costae joining and forming a "Y" at the apex and by the subtruncate posterior margin of the last visible abdominal sternite of the female.

Nothing is known of the habits or biology of this species.

Genus *Actenodes* Lacordaire

This genus contains seven species in North America, two of which might occur in Canada. Neither species has yet been found here but both occur as far north as Michigan and New York and conceivably could occur in southern Ontario.

This genus is closely related to *Chrysobothris* but the adults of *Actenodes* can easily be distinguished by the deeply incised third tarsal segment, which appears to have two long spines on each side that extend beyond the fourth segment (Fig. 58).

Nothing is known of the habits of species in this genus, but it is probably similar to that reported for *Chrysobothris* species.

Description. Head vertical, frons flat or slightly convex; clypeus emarginate in front, frequently with median tooth. Antennae rather short, variable, usually serrate from fourth segment (Figs. 39, 40). Eyes very large, elliptic, much closer on the vertex than below. Pronotum much wider than long; base sinuate, with more or less distinct median lobe. Scutellum small, triangular. Elytra variable, scabrous or punctate, with or without costae, lobed at base, attenuate posteriorly, sides serrate posteriorly. Prosternum convex on each side anteriorly, anterior margin truncate or slightly sinuate. Legs robust, profemora and mesofemora somewhat swollen, former armed with large, acutely triangular tooth; tarsi rather short, third segment of each deeply emarginate and divided into 2 long, divergent spines that extend beyond fourth segment (Fig. 58); tarsal claws simple.

Comments. This genus was revised by Fisher (1942).

Key to species of *Actenodes* of Canada

1. Fourth antennal segment strongly triangular, widest part nearly 2.0 times wider than third, following segments transverse (Fig. 20) .... ***acornis*** **(Say)** (p. 217)

Fourth antennal segment weakly triangular, widest part only slightly wider than third, following segments not transverse (Fig. 40) .. ***simi*** **Fisher** (p. 217)

Tableau des espèces d'*Actenodes* du Canada

1. Quatrième article antennaire fortement triangulaire, sa largeur maximale presque 2 fois plus large que le troisième article, les articles suivants transverses (fig. 20) .... ***acornis*** **(Say)** (p. 217)

Quatrième article antennaire faiblement triangulaire, sa largeur maximale à peine un peu plus large que le troisième article, les articles suivants non transverses (fig. 40) .... ***simi*** **Fisher** (p. 217)

Actenodes acornis (Say)

Figs. 39, 68

Buprestis acornis Say, 1839:159.

Actenodes acornis: Knull 1925:35; Chamberlin 1926:41; Fisher 1942:13; Craighead 1950:197; Wellso et al. 1976:12.

Description. Body dark bronzy green, with weak coppery reflection; ventrally purplish brown, with distinct bronzy green tinge. Head bronzy black, with a distinct purplish tinge, with narrow, longitudinal carina on vertex; surface glabrous, coarsely, deeply foveolate-punctate on frons, finely punctate on vertex. Clypeus sinuate in front, with broad, median tooth. Antennae purplish brown on basal segments, greenish black apically, fourth segment strongly triangular, nearly twice as wide as third (Fig. 39). Pronotum about 2.0 times wider than long, widest at middle; sides slightly arcuately rounded, more strongly toward apical angles; disc moderately convex, broadly, transversely impressed behind middle; surface closely, deeply, transversely rugose, coarsely punctate between rugae. Elytra about 2.0 times longer than wide; sides parallel from humeral angles to middle, then strongly converging to acutely angulated apices; basal impressions broad, shallow; surface uneven, glabrous, densely, finely, uniformly scabrous. Each elytron with 3 very weak, longitudinal costae. Ventral surface finely, sparsely punctate, transversely rugose laterally; last visible abdominal sternite strongly impressed, broadly truncate at apex, with strongly elevated, serrate, preapical ridge. Anterior tibiae straight or slightly sinuate, mesotibiae and metatibae armed with number of small teeth on inner margins (♂) or all tibiae unarmed on inner margin (♀). Length 9.5–15.0 mm.

Hosts. Reared from red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), sweet birch (*Betula lenta*), hickory (*Carya* spp.), and black oak (*Quercus velutina*); adults collected on common persimmon (*Diospyros virginiana*).

Distribution. Eastern United States north to Michigan. Not recorded from Canada but should occur in southern Ontario.

Comments. Little variation is recorded for this species. The color on the dorsal surface may be more purplish on some specimens, the sides of the pronotum may be straight or slightly rounded, and the teeth on the tibiae of some males may be obsolete.

Nothing is known of the habits or life history of this species except that it breeds in the dry heartwood of its hosts (Baker 1972).

Actenodes simi Fisher

Figs. 40, 58

Actenodes simi Fisher, 1940:176; Fisher 1942:15; Wellso et al. 1976:12.

Description. Body bronzy black, with weak coppery or purplish tinge; ventrally bluish black, with distinct greenish or violet tinge; otherwise similar to *acornis* except fourth antennal segment weakly triangular, only slightly wider than third (Fig. 40). Length 9.5–15.0 mm.

Hosts. Unknown.

Distribution. Eastern United States, north to Michigan. Not recorded in Canada but may occur in southern Ontario.

Comments. Adults of this species resemble *acornis* but are easily separated by the antennal character given in the key and description.
Nothing is known of the habits or life history of this species.

Genus *Eupristocerus* Deyrolle

This genus contains only one species, which is distributed throughout eastern North America.

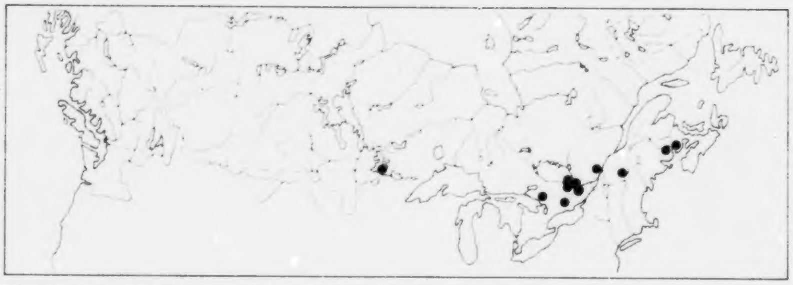
Description. Head convex, deeply grooved, surface weakly punctured; clypeus broadly emarginate in front. Antennae broadly serrate from fourth segment (Fig. 47), inserted on front of head. Eyes large, oblong. Pronotum wider than long, lateral margins explanate, lateral portions deeply impressed posteriorly; base sinuate; surface weakly granulose. Scutellum transverse, with an acute projection posteriorly. Elytra elongate, elevated at base, with humeral impressions; surface densely punctate. Prosternum short, not expanded behind procoxae, apex obtuse. Legs slender; femora slender, not dentate, flattened on inner margin; tibiae slender, straight; tarsi with first four segments equal in length; tarsal claws cleft, inner tooth broad.

Eupristocerus cognitans (Weber)

Figs. 3, 47, 60, 211; Map 55

Buprestis cognitans Weber, 1801:75.
Eupristocerus cognitans: Chamberlin, 1926:201; Wellso et al. 1976:13.
Buprestis ignarus Fabricius, 1801:211.
Buprestis ruficollis Herbst, 1801:4.

Description. Head black with purplish reflections; pronotum black in middle, with purplish reflections, and with distinct yellowish reflections on laterally impressed areas; elytra dull black or bluish black; ventrally more shining, black. Head convex, with deep, longitudinal impression extending from epistoma to vertex and with distinct transversely, sinuate groove just above antennal insertions; surface obscurely rugulose; epistoma broadly emarginate in front. Pronotum about 1.7–1.8 times wider than long, widest at middle; sides somewhat explanate, weakly serrate, arcuate from anterior to posterior angles, more strongly arcuate anteriorly; disc strongly convex



Map 55. Collection localities of *Eupristocerus cognitans*.

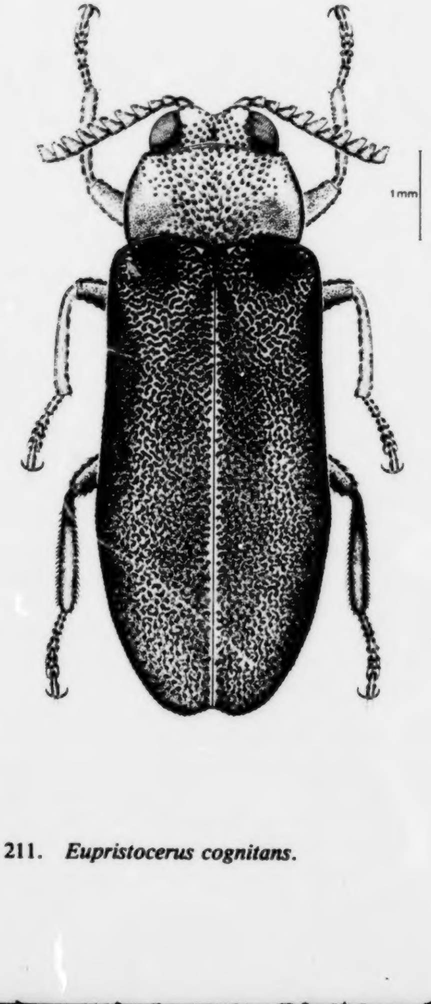


Fig. 211. *Eupristocerus cognitans*.

in middle, deeply, broadly impressed at posterior angles, and more weakly impressed before scutellum; surface weakly rugulose. Elytra elongate; sides sinuate, weakly constricted before middle, moderately expanded behind middle, converging to broadly rounded, weakly serrulate apices; disc broadly impressed at humeral angles, and sutural margin slightly elevated on apical half; surface densely punctured, weakly granulose. Ventral surface finely imbricate; last visible abdominal sternite truncate at apex (♂) or apex rounded (♀). Tibiae slender, unmodified. Tarsi with segments 1–4 equal or nearly equal in length. Tarsal claws cleft beyond middle, inner tooth broader, slightly shorter than outer tooth, tips widely separated. Length 7.2–8.5 mm.

Hosts. Reared from galls on alder (*Alnus* spp.).

Distribution. Ontario to New Brunswick, south through the eastern United States.

Comments. This species is easily distinguished by the characters given in the key and description.

Adults of this species lay eggs on small twigs at branch nodes or where the bark is rough. After hatching, the young larvae enter the bark and work down the stem for a short distance. They then encircle the stem, which causes a gall to form. The larvae remain in the gall and pupate near the uppermost portion. Two years is required to complete a generation.

Genus *Agrilus* Curtis

This is a large genus of over 120 species distributed throughout North America. Fifty-three species occur in Canada or might be found in the country in the future. Several of the species are economically important.

Because of the large number of closely related species, identification of particular specimens may be difficult. Several species are considered to be a composite of a number of host-specific sibling species. These species cannot be easily separated by any external or internal characters, but the forms have become adapted to a specific genus or species of host plant.

No species, as far as is known, live in coniferous hosts.

Description. Head vertical and grooved, flat, tuberculate or simply convex in front; clypeus emarginate in front, narrowed by antennal cavities. Antennae variable in length, serrate from fourth or fifth segments (Figs. 45, 46), not inserted in groove in prosternum in repose. Eyes large, oblong. Pronotum usually wider than long, convex, broadly sinuate in front; sides arcuately rounded, with 2 distinct margins; base sinuate with a broad, median lobe; surface with or without depressions, usually with distinct carina near posterior angles. Scutellum broad, acute posteriorly, sometimes transversely carinate. Elytra elongate, sinuate at base, with or without longitudinal costae; apex expanded, broadly rounded, acute or strongly dentate. Prosternum broad, more or less lobed in front. Legs slender; femora fusiform, not dentate on inner margin, frequently more strongly swollen in males; tibiae slender, subcylindrical; tarsi long, slender, segments armed with distinct lamellae; tarsal claws cleft or dentate (Figs. 63–66).

Comments. This genus was revised by Fisher (1928). Barr (1971) treated the species of the Pacific Northwest and Wellso et al. (1976) give a key to the species occurring in Michigan.

All species known to occur or suspected of occurring in Canada are treated here.

Key to species of *Agrilus* in Canada and Alaska

1. Elytral apices prolonged, terminating in large spine; eastern ..... *ferrisi* **Dury** (p. 229)
   Elytral apices not prolonged 2
2. Antenna serrate beginning at segment 4 (Fig. 45) 3
   Antenna serrate beginning at segment 5 (Fig. 46) 39
3. Inner teeth of tarsal claws turned inward, touching or nearly touching each other (Fig. 63) 4
   Inner teeth of tarsal claws not turned inward, or, if turned inward, only weakly so, tips widely separated (Figs. 64–66) 21
4. Pygidium with carina projecting beyond apical margin (Fig. 61) 5
   Pygidium with carina not projecting beyond apical margin or carina absent 7
5. Body bicolored above, head and pronotum brassy or coppery, elytra black 6
   Body uniformly black dorsally; on ironwood; eastern ..... *champlaini* **Frost** (p. 231)
6. Front of head deeply impressed at vertex; elytra black, and without distinct pubescence; body black ventrally; on *Rubus* spp.; eastern ..... *ruficollis* **(Fabricius)** (p. 232)
   Front of head feebly impressed at vertex; elytra black and uniformly clothed with very short hairs; body brassy or coppery ventrally; on bayberry; eastern ..... *sayi* **Saunders** (p. 233)
7. Vertical portions of abdominal sternites without distinct pubescent spots, sometimes clothed uniformly with pubescence over entire surface; ventral surface of abdomen without distinct pubescent spots 8
   Vertical portions of abdominal sternites and ventral surface of abdomen with distinct pubescent spots; on honeylocust and prickley ash; eastern ..... *difficilis* **Gory** (p. 235)
8. Claws on anterior tarsi with inner teeth contiguous or nearly contiguous at apex 9
   Claws on anterior tarsi with inner teeth distinctly separated at apex; on manzanita; British Columbia ..... *arbuti* **Fisher** (in part) (p. 236)
9. Male with anterior and middle tibiae armed with distinct tooth on inner margin at apex 10
   Male with all tibiae armed with distinct tooth on inner margin at apex 12
10. Posterior tarsi of male as long as or longer than tibiae, first segment as long as following four segments combined; median portion of male prosternum with distinct patch of long, dense setae; body slightly smaller, 4–6.5 mm long; on maple; eastern ..... *masculinus* **Horn** (p. 237)

Posterior tarsi of male shorter than tibiae, first segment as long as following three segments combined; median portion of male prosternum with indistinct patch of less dense setae 11

11. Elytra with vague pubescent stripe; length 5.5 mm; Michigan .... ***paramasculinus* Champlain & Knull** (p. 238)

Elytra without pubescent stripe; length 7.5 mm; on oak, chestnut, hazel, beech, hickory; Manitoba to New Brunswick .... ***arcuatus* (Say)** (p. 239)

12. Male antennae not longer than pronotum, and not ciliate beneath 13

Male antennae longer than pronotum, slender and ciliate beneath (Fig. 44); hosts unknown; eastern .... ***crinicornis* Horn** (p. 240)

13. Last abdominal sternite of male not fimbriate at apex 14

Last abdominal sternite of male truncate and fimbriate at apex; on oak; eastern .... ***defectus* LeConte** (p. 242)

14. Prosternum of male conspicuously pubescent 15

Prosternum of male not conspicuously pubescent 18

15. Prosternum truncate or slightly emarginate 16

Prosternum deeply emarginate; on black walnut; eastern .... ***cliftoni* Knull** (p. 243)

16. Prehumeral carina of pronotum distinct; aedeagus with sides of lateral lobes expanded 17

Prehumeral carina of pronotum indistinct; aedeagus with sides of lateral lobes parallel (Fig. 222); on oak; eastern .... ***geminatus* (Say)** (p. 244)

17. Male with front of head densely clothed with long, white setae above epistoma, these nearly concealing surface; sides of aedeagus not transparent at apex (Fig. 223); on hickory; eastern .... ***otiosus* Say** (p. 245)

Male with front of head sparsely clothed with long, white setae above epistoma; sides of aedeagus broadly transparent toward apex (Fig. 224); on hazel; eastern .... ***atricornis* Fisher** (p. 246)

18. Second abdominal sternite of male not transversely concave 19

Second abdominal sternite of male transversely concave; on black locust; eastern .... ***transimpressus* Fall** (p. 247)

19. Aedeagus without protruding fleshy lobes at apex of lateral lobes; frons bluish or greenish 20

Aedeagus with protruding fleshy lobes at apex of lateral lobes; frons usually green; on hop hornbeam; eastern .... ***osburni* Knull** (p. 248)

20. First and second abdominal sternites of male weakly, longitudinally flattened at middle; sides of median lobe of aedeagus strongly, arcuately expanded near apex (Fig. 226); on oak; eastern .... ***frosti* Knull** (p. 249)

First and second abdominal sternites of male not flattened at middle; sides of median lobe of aedeagus arcuately expanded near middle, parallel toward apex (Fig. 227); on butternut; eastern .... ***juglandis* Knull** (p. 250)

21. Pygidium with projecting carina (Fig. 61) 22

Pygidium without projecting carina 30

22. Pronotum without densely pubescent, median, longitudinal groove 23

Pronotum with densely pubescent, median, longitudinal groove; on serviceberry, hawthorn, chokecherry, *Pyrus* spp., and *Malus* spp.; British Columbia to Ontario .... ***vittaticollis* (Randall)** (p. 252)

23. Pronotum with distinct prehumeral carinae .... ***anxius*** complex (p. 253)

Pronotum without prehumeral carinae, or, if present, only weakly indicated 24

24. Elytra with pubescent stripes, these sometimes indicated only in basal depressions 25

Elytra without pubescent stripes 26

25. Elytra black, each with distinct whitish or yellowish stripe; on chestnut and oak; Manitoba to Quebec .... ***bilineatus bilineatus*** **(Weber)** (p. 263)
Elytra blue or bluish black, each with indistinct pubescent stripe in basal depressions; on American hornbeam, beech, and hop hornbeam; Ontario, Quebec .... ***bilineatus carpini*** **Knull** (p. 265)

26. Vertical portions of abdominal sternites densely pubescent (except sometimes the second) 27
Vertical portions of abdominal sternites not pubescent; on willow; Saskatchewan to New Brunswick .... ***criddlei*** **Frost** (p. 266)

27. Vertical portions of second abdominal sternite glabrous 28
Vertical portions of second abdominal sternite more or less pubescent .. 29

28. Elytra blue or blue black; elytral apices rather broadly rounded, rarely acute; on birch, oak, poplar, and American hazel; Manitoba to Quebec .... ***acutipennis*** **Mannerheim** (p. 268)
Elytra brassy to greenish black; elytral apices more acutely rounded; on oak; Ontario .... ***nigricans*** **Gory** (in part) (p. 269)

29. Elytral apices usually broadly rounded; pubescence on ventral surface of abdomen white or yellowish white; on oak; eastern .... ***quadriimpressus*** **Ziegler** (p. 270)
Elytral apices more acutely rounded; pubescence on ventral surface of abdomen usually golden yellow; on oak; Ontario .... ***nigricans*** **Gory** (in part) (p. 269)

30. Suture between first and second abdominal sternites distinct at sides; elytra bronzy green to blue with white pubescent spots; pronotum punctured and with broad, deep, median impression extending from base to near anterior margin; frons deeply impressed; on rabbitbrush; British Columbia .... ***walsinghami*** **Crotch** (p. 272)
Without above combination of characters 31

31. Elytra with pubescent spots or lines 32
Elytra without pubescent spots or lines 33

32. Prosternum deeply emarginate in front; on various hardwoods; eastern .... ***obsoletoguttatus*** **Gory** (p. 273)
Prosternum shallowly emarginate in front; on honeylocust and hackberry; Ontario, Quebec .... ***fallax*** **Say** (p. 274)

33. Anterior tarsal claws with inner teeth not turned inward 34
Anterior tarsal claws with inner teeth weakly turned inward, tips widely separated; on manzanita; British Columbia .... ***arbuti*** **Fisher** (in part) (p. 236)

34. Antennal segments 7-11 distinctly wider than long 35
Antennal segments 7-11 not distinctly wider than long 36

35. Prosternum broadly rounded anteriorly; on *Rubus* spp., and *Rosa* spp.; Ontario and Quebec .... ***aurichalceus*** **Redtenbacher** (p. 275)
Prosternum subtruncate or more or less emarginate anteriorly; on willow; maple, alder, and hazel .... ***politus*** complex (p. 277)

36. Dorsally not bluish, elytra bronze to purple reddish; prosternum shallowly emarginate anteriorly 37
Dorsally dark blue to greenish blue; prosternum deeply emarginate anteriorly; on Tartarian honeysuckle; eastern ..... ***cyanescens*** **(Ratzeburg)** (p. 280)

37. Elytra usually reddish at apex or with purple tinge; setae on lower fourth of frons less dense, not obscuring surface 38
Elytra blackish bronze to greenish; setae on lower fourth of frons dense, obscuring surface; on dogwood; British Columbia to Ontario .... ***cephalicus*** **LeConte** (p. 282)

38. Body unicolored dorsally; on hawthorn; Alberta to Ontario ..... *crataegi* **Frost** (p. 283)

Body bicolored dorsally, pronotum coppery, and elytra purplish to blackish; on *Amelanchier* spp.; Ontario (?) ..... *amelanchieri* **Knull** (p. 284)

39. Elytra with pubescent spots, lines, or irregular designs 40

Elytra without pubescent spots, lines, or irregular designs, uniformly pubescent 47

40. Pronotum without prehumeral carinae; on green ash; Ontario ..... *subcinctus* **Gory** (p. 285)

Pronotum with prehumeral carinae (sometimes obscure) 41

41. Elytra with irregular, pubescent designs; on hackberry; Ontario ..... *lecontei* **Saunders** (p. 286)

Elytra with distinct, regular, pubescent spots or lines 42

42. Elytra with rounded or elongate, pubescent spots; eastern species in honey-locust 43

Elytra with longitudinal, pubescent stripe along sutural margins 46

43. Front of head more or less concave, distinctly longitudinally impressed 44

Front of head convex, or at most, only weakly longitudinally impressed 45

44. Pubescent spots on elytra distinct, basal and median spots separated; length 6.5-7.5 mm; South Dakota, Minnesota ..... *impexus* **Horn** (p. 287)

Pubescent spots on elytra not distinct, often obsolete, basal and median spots usually connected; length 6.0 mm; North Dakota ..... *addendus* **Crotch** (p. 288)

45. Pubescent spots on elytra distinct, median pair rounded; pronotum with distinct median impressions; female with frons mahogany red; Michigan ..... *pseudofallax* **Frost** (p. 288)

Pubescent spots on elytra usually not distinct, median pair elongate; pronotum with feeble median impressions; female with frons bronzy green; Michigan ..... *egeniformis* **Champlain & Knull** (p. 289)

46. Prosternum distinctly emarginate anteriorly; on hackberry (?) and oak (?); eastern ..... *olentangyi* **Champlain & Knull** (in part) (p. 290)

Prosternum subtruncate anteriorly; on *Malvastrum* and *Sphaeraicea*; Alberta ..... *malvastri* **Fisher** (p. 290)

47. Pronotum without prehumeral carinae; on maple; Ontario ..... *putillus* **Say** (p. 292)

Pronotum with prehumeral carinae 48

48. Hind coxae with posterior margin distinctly sinuate or arcuately emarginate, outer posterior angle more or less acute and somewhat prolonged 49

Hind coxae with posterior margin feebly sinuate or truncate, outer posterior angle rectangular and not prolonged 50

49. Posterior tarsi of male distinctly longer than tibiae; eyes more acutely rounded ventrally than dorsally; on *Croton*; Ontario .. *lacustris* **LeConte** (p. 293)

Posterior tarsi of male not longer than tibiae; eyes evenly rounded ventrally and dorsally; on *Helianthemum*; Ontario ..... *imbellis* **Crotch** (p. 294)

50. Elytra clothed with very short, white hairs 51

Elytra sparsely and uniformly clothed with distinct, long, white hairs, except sometimes in humeral region; on hackberry (?) and oak (?); probably in southern Ontario ..... *olentangyi* **Champlain & Knull** (in part) (p. 290)

51. Body dorsally unicolored, brownish or greenish bronze 52

Body dorsally bicolored, head and pronotum brassy or coppery, elytra purplish black; on *Amorpha*; Manitoba ..... *parvus* **Saunders** (p. 295)

52. Each elytron with distinct pubescence only in humeral depression 53

Each elytron with indistinct, often interrupted sutural stripe; on hackberry; eastern .... *paracelti* **Knull** (p. 296)

53. Aedeagus with sides of lateral lobes, strongly, arcuately expanded (Fig. 255); on black locust; eastern .... *egenus* **Gory** (p. 297)

Aedeagus with sides of lateral lobes nearly parallel; on hackberry; Ontario .... *celti* **Knull** (p. 298)

Tableau des espèces d'*Agrilus* du Canada et de l'Alaska

1. Apex de chaque élytre prolongé, se terminant en grosse épine; espèce de l'Est .... *ferrisi* **Dury** (p. 229)

Apex de chaque élytre non prolongé 2

2. Antenne dentée à partir du quatrième article (fig. 45) 3

Antenne dentée à partir du cinquième article (fig. 46) 39

3. Griffes des tarses avec les dents internes convergentes, les extrémités contigues ou presque (fig. 63) 4

Griffes des tarses avec les dents internes non ou faiblement convergentes, les extrémités bien séparées (fig. 64-66) 21

4. Pygidium avec une carène dépassant la marge apicale (fig. 61) 5

Pygidium avec carène ou avec une carène ne dépassant pas la marge apicale 7

5. Dessus du corps bicolore, tête et pronotum cuivrés, élytres noirs 6

Dessus du corps uniformément noir; sur ostryer de Virginie; espèce de l'Est .... *champlaini* **Frost** (p. 231)

6. Front profondément marqué au niveau du vertex; élytres noirs et sans pubescence distincte; dessous du corps noir; sur les *Rubus* spp.; espèce de l'Est .... *ruficollis* **(Fabricius)** (p. 232)

Front faiblement marqué au niveau du vertex; élytres noirs et uniformément couvert de très courtes soies; dessous du corps cuivrés ou cuivré jaune; sur les berbéris; espèces de l'Est .... *sayi* **Saunders** (p. 233)

7. Portions verticales des segments abdominaux sans zones pubescentes distinctes, parfois avec pubescence uniforme sur toute la surface; surface ventrale de l'abdomen sans zones pubescentes distinctes 8

Portions verticales des segments abdominaux et surface ventrale de l'abdomen avec des zones pubescentes distinctes; sur le févier à trois épines et le clavalier d'Amérique; espèce de l'Est .... *difficilis* **Gory** (p. 235)

8. Griffes des tarses antérieures avec les dents internes contigues ou presque à l'apex 9

Griffes des tarses antérieures avec les dents internes bien séparées à l'apex; sur le raisin d'ours; Colombie-Britannique .... *arbuti* **Fisher** (en partie) (p. 236)

9. Protibiae et mésotibiae du mâle avec une dent distincte sur la marge interne à l'apex 10

Tous les tibiae du mâle avec une dent distincte sur la marge interne à l'apex 12

10. Tarses postérieurs du mâle aussi longs ou plus longs que les tibiae, premier article aussi long que les quatre articles suivants réunis; portion médiane du prosternum chez le mâle avec une zone de soies longues et denses; corps un peu plus petit, 4-6,5 mm de longueur; sur l'érable; espèce de l'Est .... *masculinus* **Horn** (p. 237)

Tarses postérieurs du mâle plus courts que les tibiae, premier article aussi long que les trois articles suivants réunis; portion médiane du prosternum chez le mâle avec une zone peu distincte de soies moins denses 11

11. Élytres avec une vague bande pubescente; longueur 5,5 mm; Michigan .... ***paramasculinus*** **Champlain & Knull** (p. 238)

Élytres sans bande pubescente; longueur 7,5 mm; sur le chêne, la châtaigne, le noisetier, l'hêtre, l'hickory; Manitoba jusqu'au Nouveau-Brunswick .... ***arcuatus*** **(Say)** (p. 239)

12. Antennes du mâle pas plus longues que le pronotum, et non ciliées en-dessou 13

Antennes du mâle plus longues que le pronotum, minces et ciliées en-dessous (fig. 44); hôtes inconnus; espèce de l'Est ..... ***crinicornis*** **Horn** (p. 240)

13. Dernier sternite abdominal du mâle sans soies à l'apex 14

Dernier sternite abdominal du mâle tronqué et avec des soies à l'apex; sur le chêne; espèce de l'Est .... ***defectus*** **LeConte** (p. 242)

14. Prosternum du mâle distinctement pubescent 15

Prosternum du mâle non distinctement pubescent 18

15. Prosternum tronqué ou faiblement échancré 16

Prosternum fortement échancré; sur le noyer noir; espèce de l'Est .... ***cliftoni*** **Knull** (p. 243)

16. Carène préhumérale du pronotum distincte; édéage avec les côtés des lobes latéraux élargis 17

Carène préhumérale du pronotum non distincte; édéage avec les côtés des lobes latéraux parallèles (fig. 222); sur le chêne; espèce de l'Est .... ***geminatus*** **(Say)** (p. 244)

17. Front chez le mâle densément couvert de longues soies blanches au-dessus de l'épistome, obscurant presque la surface; côtés de l'édéage non transparents à l'apex (fig. 223); sur le caryer; espèce de l'Est ... ***otiosus*** **Say** (p. 245)

Front chez le mâle couvert de longues soies blanches éparses au-dessus de l'épistome; côtés de l'édéage largement transparents vers l'apex (fig. 224); sur le noisetier; espèce de l'Est .... ***atricornis*** **Fisher** (p. 246)

18. Deuxième sternite abdominal du mâle non transversalement concave ... 19

Deuxième sternite abdominal du mâle transversalement concave; sur le robinier faux acacia; espèce de l'Est .... ***transimpressus*** **Fall** (p. 247)

19. Édéage sans lobes charnus saillants à l'apex des lobes latéraux; front bleuâtre ou verdâtre 20

Édéage avec des lobes charnus saillants à l'apex des lobes latéraux; front généralement vert; sur le charme houblon; espèce de l'Est .... ***osburni*** **Knull** (p. 248)

20. Premier et deuxième sternites abdominaux du mâle faiblement aplatis longitudinalement au milieu; côtés du lobe médian de l'édéage fortement élargis près de l'apex (fig. 226); sur le chêne; espèce de l'Est .... ***frosti*** **Knull** (p. 249)

Premier et deuxième sternites abdominaux du mâle non aplatis au milieu; côtés du lobe médian de l'édéage élargis près du milieu, parallèles vers l'apex (fig. 227); sur le noyer cendré; espèce de l'Est ...... ***juglandis*** **Knull** (p. 250)

21. Pygidium avec une carène saillante (fig. 61) 22

Pygidium sans carène saillante 30

22. Pronotum sans sillon longitudinal, fortement pubescent au milieu 23

Pronotum avec un sillon longitudinal médian, fortement pubescent au milieu; sur l'amélanchier, l'aubépine, l'aronia, les *Pyrus* spp., et les *Malus* spp.; Colombie-Britannique jusqu'à l'Ontario .... ***vittaticollis*** **(Randall)** (p. 252)

23. Pronotum avec une carène préhumérale distincte ..complexe ***anxius*** (p. 253)
Pronotum avec une faible carène préhumérale ou sans carène 24

24. Élytres avec des bandes pubescentes, parfois visibles seulement dans les dépressions basales 25
Élytres sans bandes pubescentes 26

25. Élytres noirs, chacun avec une bande blanchâtre ou jaunâtre distincte; sur le châtaigne et le chêne; Manitoba jusqu'au Québec .... ***bilineatus bilineatus*** **(Weber)** (p. 263)
Élytres bleus ou bleuâtre noir, chacun avec une bande pubescente indistincte dans les dépressions basales; sur le charme américain, l'hêtre et le charme houblon; Ontario, Québec .... ***bilineatus carpini*** **Knull** (p. 265)

26. Portions verticales des sternites abdominaux densément pubescentes (sauf parfois le deuxième) 27
Portions verticales des sternites abdominaux non pubescentes; sur le saule; Saskatchewan jusqu'au Nouveau-Brunswick .... ***criddlei*** **Frost** (p. 266)

27. Portions verticales du deuxième sternite abdominal glabres 28
Portions verticales du deuxième sternite abdominal plus ou moins pubescentes 29

28. Élytres bleus ou bleu-noir; apex de chaque élytre plutôt largement arrondi, rarement aigu; sur le bouleau, le chêne, le peuplier et le noisetier américain; Manitoba jusqu'au Québec .... ***acutipennis*** **Mannerheim** (p. 268)
Élytres cuivré jaune à noir verdâtre; apex de chaque élytre plus étroitement arrondi; sur le chêne; Ontario ...... ***nigricans*** **Gory** (en partie) (p. 269)

29. Apex de chaque élytre généralement largement arrondi; surface ventrale de l'abdomen avec une pubescence blanche ou blanc jaunâtre; sur le chêne; espèce de l'Est .... ***quadriimpressus*** **Ziegler** (p. 270)
Apex de chaque élytre plus étroitement arrondi; surface ventrale de l'abdomen avec une pubescence généralement jaune doré; sur le chêne; Ontario .... ***nigricans*** **Gory** (en partie) (p. 269)

30. Suture entre le premier et le deuxième sternite abdominal distincte sur les côtés; élytres vert bronzé à bleu avec des taches blanches pubescentes; pronotum ponctué et avec une large et profonde impression médiane s'étendant de la base à presque la marge antérieure; front profondément marqué; sur *Chrysothamnus*; Colombie-Britannique .... ***walsinghami*** **Crotch** (p. 272)
Sans la combinaison des caractéristiques mentionnées 31

31. Élytres avec des taches ou des lignes pubescentes 32
Élytres sans taches ou lignes pubescentes 33

32. Prosternum profondément échancré en avant; sur divers bois durs; espèce de l'Est .... ***obsoletoguttatus*** **Gory** (p. 273)
Prosternum légèrement échancré en avant; sur le février à trois épines et le micocoulier occidental; Ontario, Québec .... ***fallax*** **Say** (p. 274)

33. Griffes des tarses antérieurs avec les dents internes non convergentes ... 34
Griffes des tarses antérieurs avec les dents internes légèrement convergentes, les extrémités largement séparées; sur le raisin d'ours; Colombie-Britannique .... ***arbuti*** **Fisher** (en partie) (p. 236)

34. Articles antennaires 7-11 distinctement plus larges que longs 35
Articles antennaires 7-11 non distinctement plus larges que longs 36

35. Prosternum largement arrondi antérieurement; sur *Rubus* spp. et *Rosa* spp.; Ontario et Québec .... ***aurichalceus*** **Redtenbacher** (p. 275)
Prosternum subtronqué ou plus ou moins échancré antérieurement; sur le saule, l'érable, l'aulne et le noisetier .... complexe ***politus*** (p. 277)

36. Surface dorsale non bleuâtre, élytres bronzés à violet rougeâtre; prosternum faiblement échancré antérieurement 37

Surface dorsale bleu foncé à bleu verdâtre; prosternum profondément échancré antérieurement; sur le chèvrefeuille de Tartarie; espèce de l'Est .... ***cyanescens*** **(Ratzeburg)** (p. 280)

37. Élytres généralement rougeâtres à l'apex ou avec une teinte violette; soies sur le quart inférieur du front moins denses, n'obscurant pas la surface 38

Élytres bronzé noirâtre à verdâtres; soies sur le quart inférieur du front denses, obscurant la surface; sur le cornouiller; Colombie-Britannique jusqu'à l'Ontario .... ***cephalicus*** **LeConte** (p. 282)

38. Surface dorsale unicolore; sur l'aubépine; Alberta jusqu'à l'Ontario .... ***crataegi*** **Frost** (p. 283)

Surface dorsale bicolore, pronotum cuivré, élytres violacés à noirâtres; sur *Amelanchier* spp.; Ontario (?) .... ***amelanchieri*** **Knull** (p. 284)

39. Élytres avec des taches, lignes, ou dessins irréguliers pubescents 40

Élytres uniformément pubescents, sans taches, lignes, ou dessins irréguliers pubescents 47

40. Pronotum sans carène préhumérale; sur le frêne vert; Ontario .... ***subcinctus*** **Gory** (p. 285)

Pronotum avec une carène préhumérale (parfois obscure) 41

41. Élytres avec des dessins irréguliers pubescents; sur le micocoulier occidental; Ontario .... ***lecontei*** **Saunders** (p. 286)

Élytres avec des taches ou lignes régulières pubescentes 42

42. Élytres avec des taches pubescentes arrondies ou allongées; espèces de l'Est dans le févier à trois épines 43

Élytres avec une bande longitudinale pubescente le long des marges suturales 46

43. Front plus ou moins concave, distinctement marqué longitudinalement ... 44

Front convexe, ou au plus faiblement marqué longitudinalement 45

44. Taches pubescentes sur les élytres distinctes, taches basales et médianes séparées; longueur 6,5–7,5 mm; Dakota Sud, Minnesota .. ***impexus*** **Horn** (p. 287)

Taches pubescentes sur les élytres non distinctes, souvent effacées, taches basales et médianes généralement jointes; longueur 6,0 mm; Dakota Nord ..... ***addendus*** **Crotch** (p. 288)

45. Taches pubescentes des élytres distinctes, la paire médiane arrondie; pronotum avec des marques médianes distinctes; front chez la femelle acajou; Michigan .... ***pseudofallax*** **Frost** (p. 288)

Taches pubescentes des élytres généralement non distinctes, la paire médiane allongée; pronotum avec de faibles marques médianes; front chez la femelle vert bronzé; Michigan .... ***egeniformis*** **Champlain & Knull** (p. 289)

46. Prosternum distinctement échancré antérieurement; sur le micocoulier occidental (?) et le chêne (?); espèce de l'Est .... ***oletangyi*** **Champlain & Knull** (en partie) (p. 290)

Prosternum subtronqué antérieurement; sur *Malvastrum* et *Sphaeraicea*; Alberta .... ***malvastri*** **Fisher** (p. 290)

47. Pronotum sans carènes préhumérales; sur l'érable; Ontario .... ***putillus*** **Say** (p. 292)

Pronotum avec des carènes préhumérales 48

48. Coxae postérieures avec la marge postérieure distinctement sinueuse ou échancrée, l'angle postérieur externe plus ou moins aigu et plutôt prolongé 49

Coxae postérieures avec la marge postérieure faiblement sinueuse ou tronquée, l'angle postérieur externe rectangulaire et non prolongé 50

49. Tarses postérieurs du mâle distinctement plus longs que les tibiae; yeux plus largement arrondis sur la partie ventrale que dorsale; sur *Croton*; Ontario ... . ***lacustris* LeConte** (p. 293)

Tarses postérieurs du mâle pas plus longs que les tibiae; yeux uniformément arrondis ventralement et dorsalement; sur *Helianthemum*; Ontario .... ***imbellis* Crotch** (p. 294)

50. Élytres couverts de très courtes soies blanches 51

Élytres uniformément couverts de longues soies blanches éparses, sauf parfois dans la région humérale; sur le micocoulier occidental (?) et le chêne (?); probablement dans le sud de l'Ontario .... ***olentangyi* Champlain & Knull** (en partie) (p. 290)

51. Surface dorsale unicolore, brunâtre ou bronzé verdâtre 52

Surface dorsale bicolore, tête et pronotum cuivrés ou cuivré jaune, élytres noir violacé; sur *Amorpha*; Manitoba .... ***parvus* Saunders** (p. 295)

52. Chaque élytre avec une pubescence distincte seulement dans la dépression humérale 53

Chaque élytre avec une bande suturale indistincte, souvent interrompue; sur le micocoulier occidental; espèce de l'Est .... ***paracelti* Knull** (p. 296)

53. Côtés des lobes latéraux de l'édéage fortement élargis (fig. 255); sur le robinier faux-acacia; espèce de l'Est .... ***egenus* Gory** (p. 297)

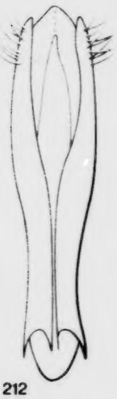
Côtés des lobes latéraux de l'édéage presque parallèles; sur le micocoulier occidental; Ontario .... ***celti* Knull** (p. 298)

Agrilus ferrisi Dury

Fig. 212

Agrilus ferrisi Dury, 1908:368; Chamberlin 1926:62; Fisher 1928:78; Wellso et al. 1976:13.

Description. Uniformly brassy, with a strong coppery red or violet tinge; ventrally coppery red. Head rather wide, flat, with feeble longitudinal groove extending from vertex to middle of frons; surface coarsely punctate, longitudinally rugose on vertex, with abundant long, recumbent, yellowish white pubescence and efflorescence; epistoma strongly transverse between antennae, strongly elevated, deeply, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum 0.5 times wider than long, widest at middle; sides weakly, arcuately rounded, slightly sinuate near posterior angles; disc moderately convex, with vague, longitudinal impression, with broad, shallow impression along lateral margin and with rounded, arcuate prehumeral carinae; surface coarsely, transversely rugose at middle, sparsely, coarsely punctate between rugae. Elytra slightly wider at base than behind middle; sides vaguely constricted before middle, weakly, broadly expanded behind middle, then obliquely narrowed to strongly serrate apices which are produced into an acute spine at midline of each elytron; disc flattened, weakly concave along sutural margins and with weak, obtuse costae on each elytron, with wide, deep basal depressions; surface coarsely imbricate-punctate, somewhat transversely rugose. Ventral surface finely, sparsely punctate;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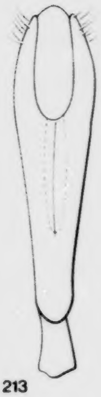
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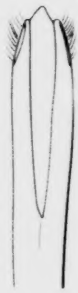
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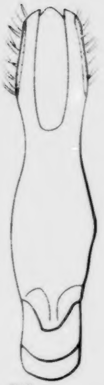
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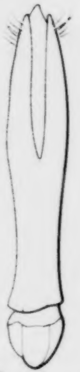
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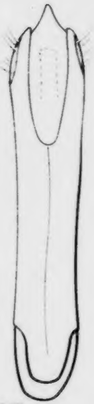
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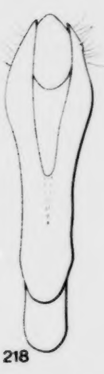
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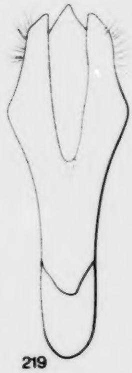
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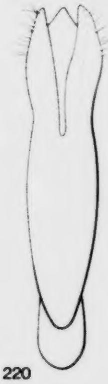
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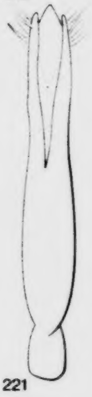
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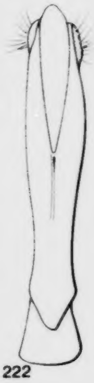
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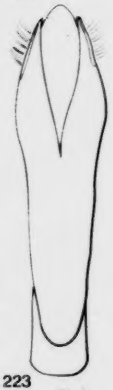
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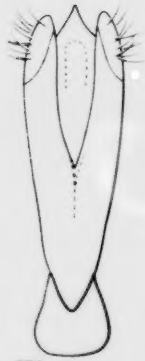
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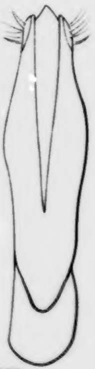
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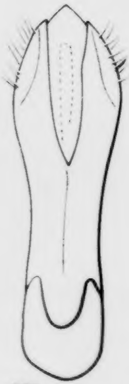
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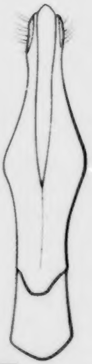
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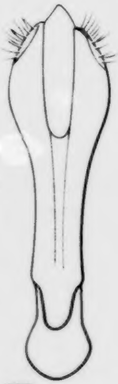
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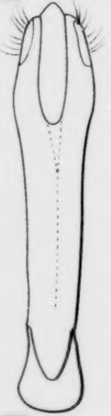
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pygidium longitudinally carinate, carina not projecting but tip of pygidium broadly projecting, strongly emarginate at apex; last visible abdominal sternite broadly truncate at apex, with marginal groove extending along sides and apex (♂) or apex more broadly truncate, marginal groove present only at sides (♀). Tibiae slender, anterior pair weakly arcuate, anterior and middle pair with short, indistinct tooth on inner margin at apex (♂) or tibiae unarmed (♀). Tarsal claws similar on all tarsi, cleft near middle, inner tooth broad, much shorter than outer one, not turned inward. Aedeagus as in Fig. 212. Length 8.7-10.0 mm.

Hosts. Recorded only from hackberry (*Celtis occidentalis*).

Distribution. Midwestern United States, north to Michigan; not yet recorded from Canada but to be expected in southern Ontario.

Comments. The adults of this species may be easily recognized by the acute apices of the elytra. Some variation occurs in the color of the dorsal surface but in general the characters given in the description hold true.

This species is included here based on Wellso et al.'s (1976) record of three specimens collected on hackberry from Okemos, MI; the species should be sought in the Windsor-Point Pelee area of Ontario.

Agrilus champlaini Frost

Fig. 213

Agrilus champlaini Frost, 1912:245; Knull 1925:39; Chamberlin, 1926:56; Fisher 1928:27; Craighead 1950:192; Wellso et al. 1976:14.

Description. Uniformly black, with faint purplish tinge; ventrally more shining than above, with weak brassy reflection. Head rather wide, flat, with moderately deep, broad, longitudinal depression extending from vertex to middle of frons; surface densely, coarsely punctate, coarsely rugose, with several, short, semierect, whitish setae; epistoma strongly transverse between antennae, broadly, deeply, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum 0.6 times wider than long, widest at middle; sides strongly, arcuately rounded from anterior margin to posterior angles; disc moderately convex, with two round, deep depressions in front of middle and larger, deeper impression on each side along lateral margin at middle; surface coarsely, densely, transversely rugose, with numerous punctures between the rugae. Elytra about equal in width at base and just behind

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Figs. 212-229. Aedeagi of *Agrilus* spp. (212-220, 222-229 redrawn from Fisher 1928; 221 redrawn from Knull 1941). 212, *A. ferrisi*; 213, *A. champlaini*; 214, *A. ruficollis*; 215, *A. sayi*; 216, *A. difficilis*; 217, *A. masculinus*; 218, *A. arcuatus*; 219, *A. crinicornis*; 220, *A. defectus*; 221, *A. cliftoni*; 222, *A. geminatus*; 223, *A. otiosus*; 224, *A. atricornis*; 225, *A. transimpressus*; 226, *A. frosti*; 227, *A. juglandis*; 228, *A. vittaticollis*; 229, *A. anxius*.

middle; sides arcuately constricted in front of middle, and narrowed from near middle to the broadly rounded apices; disc slightly flattened, with vague longitudinal costae, with broad, deep, basal impressions; surface densely, coarsely granulate-punctate. Ventral surface finely, densely punctate; pygidium coarsely punctate, median carina strongly elevated, narrow, strongly projecting, truncate at apex; second abdominal sternite grooved (♂) or not (♀). Tibiae slender, feebly arcuate, all armed with small tooth on inner margin at apex (♂) or tibiae unarmed (♀). Tarsal claws all similar, cleft near middle, inner tooth broader, turned inward, tips nearly touching. Aedeagus as in Fig. 213. Length 7.0–8.0 mm.

Hosts. Reared from ironwood (*Ostrya virginiana*).

Distribution. New York, Connecticut, Pennsylvania, and West Virginia; not yet recorded from Canada but should be expected in southern Ontario.

Comments. The adults of this species are generally constant except in color and size. The shape of the pronotum varies slightly but the impressions on the pronotum are variable, usually the two anterior ones are deep and distinct but occasionally these impressions are absent.

This species makes galls or conspicuous swellings on twigs and small branches of the host tree.

Agrilus ruficollis (Fabricius)

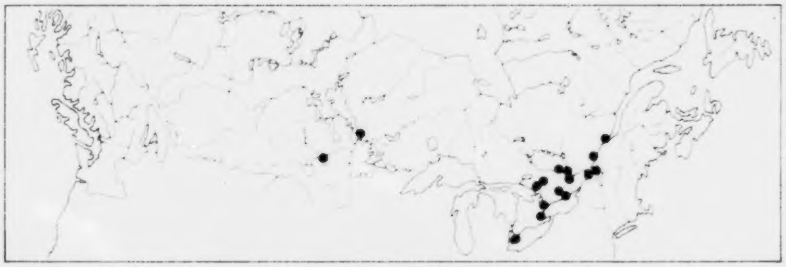
Figs. 63, 214; Map 56

Buprestis ruficollis Fabricius, 1787:184.

Agrilus ruficollis: Knull 1925:39; Chamberlin 1926:80; Fisher 1928:29; Wellso et al. 1976:14.

Agrilus cupricollis Gory, 1841:240; Hespenhide 1979:479.

Description. Head and pronotum coppery or brassy, sometimes green, blue, or black, feebly shining; elytra subopaque, black, sometimes with bluish tinge; ventrally black. Head wide, nearly flat, with broad, deep, longitudinal impression extending from epistoma to vertex, impression deepest on vertex; surface coarsely (♂) to finely (♀), sparsely punctate, more coarsely rugose on vertex and occiput; epistoma rather narrow behind antennae, broad, deep, arcuate emargination at middle, anterior margin transversely truncate on each side of emargination. Antennae serrate from fourth segment. Pronotum 0.5 times wider than long, widest at apical third; sides weakly rounded to basal third, obliquely narrowed to apical angles; disc moderately convex, with deep, transverse, concave impression on basal half, and very broad, deep impression along lateral margin at middle; surface coarsely, densely, transversely rugose with fine punctures between rugae. Elytra about equal in width at base and apical third; sides deeply, broadly constricted before middle, arcuately narrowed from apical third to broadly rounded, strongly serrulate apices; disc slightly flattened, with broad, deep, basal impressions,



Map 56. Collection localities of *Agrilus ruficollis*.

longitudinal costae absent; surface densely, finely, granulate-punctate. Ventral surface coarsely to finely punctate; pygidium coarsely punctate, median carina strongly elevated, narrow, slightly projecting, truncate at apex; first two abdominal sternites grooved (♂) or not (♀). Tibiae slender, straight, protibiae and mesotibiae with distinct, short tooth on inner margin at apex (♂) or tibiae unarmed (♀). Tarsal claws all similar, cleft near middle, inner tooth broader, turned inward, tips sometimes touching. Aedeagus as in Fig. 214. Length 4.0–7.0 mm.

Hosts. Reared from numerous varieties of blackberry and raspberry (*Rubus* spp.).

Distribution. Manitoba to Quebec, south throughout the eastern United States.

Comments. Adults of this species are constant in all characters except in size and color. The pronotum is usually reddish coppery but may vary from green, blue, or brassy to, rarely, black. The elytra are usually black but some specimens may show a faint bluish tinge.

This species attacks all varieties of blackberry and raspberry, both wild and cultivated. Attacks cause elongate swellings or galls on the canes; frequently severe damage is done to cultivated varieties. The common name of this species is rednecked cane borer.

Agrilus sayi Saunders

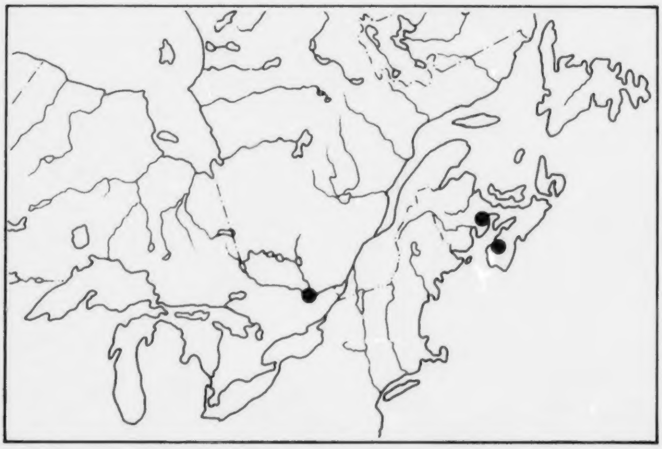
Fig. 215; Map 57

Buprestis lateralis **Say, 1823:159 (preoccupied by *B. lateralis* Olivier, 1790).**

Agrilus lateralis**: Knull 1925:39; Chamberlin 1926:68; Fisher 1928:34; Craighead 1950:191.**

Agrilus sayi **Saunders, 1871:393 (replacement name).**

Agrilus browni **Carlson and Knight, 1969:5; Bright 1981:871.**



Map 57. Collection localities of *Agrilus sayi*.

Description. Head and pronotum brassy coppery; elytra blackish; ventrally brassy, with strong coppery reflection. Head wide, nearly flat, with broad, longitudinal impression extending from epistoma to vertex; surface weakly, coarsely rugose and densely, coarsely punctate; epistoma narrow, broadly, weakly, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum 0.4 times wider than long, widest in front of middle; sides arcuately rounded from apical angles to basal third, then obliquely narrowed to apical angles; disc convex, with two round impressions at the middle, with deep, oblique impression along lateral margins near middle, and small, round impression near posterior angles, with or without distinct prehumeral carinae; surface coarsely, densely rugose, rather densely punctate. Elytra slightly wider at base than at apical third; sides nearly parallel behind humeri, broadly, arcuately constricted in front of middle, broadly expanded at apical third, obliquely attenuate to irregularly serrate, broadly rounded apices; disc slightly flattened, weakly impressed along suture, with deep, broad basal impressions; surface finely, densely granulate-punctate. Ventral surface finely, densely punctured, becoming coarsely punctate and transversely rugose on basal abdominal sternites; pygidium coarsely punctate, median carina strongly elevated, strongly projecting and truncate at apex; second abdominal sternite with deep, nearly smooth groove at middle (♂) or convex, not grooved (♀). Tibiae slender, protibiae and mesotibiae each armed with short tooth on inner margin at apex (♂) or tibiae unarmed at apex (♀). Tarsal claws similar on all tarsi, cleft near middle, outer tooth acute at apex, inner tooth broader, shorter, turned inward. Aedeagus as in Fig. 215. Length 6.0–9.0 mm.

Hosts. Reared from bayberry (*Myrica pensylvanica*). Adults collected on various plants such as sweet-fern (*Comptonia peregrina*), poplar shoots (*Populus* spp.), and oak (*Quercus* spp.).

Distribution. Eastern Canada, south through the eastern United States to Florida.

Comments. Adults of this species closely resemble those of *ruficollis* and some confusion has resulted. Adults of *sayi* can be distinguished from those of *ruficollis* by the front of the head being only weakly impressed, by the blackish elytra, which are uniformly clothed with short pubescence, and by the ventral surface being brassy or coppery, whereas in *ruficollis* the head is deeply impressed in front, the elytra and ventral surfaces are black, and the elytra are without distinct pubescence.

As previously stated, there has been some confusion as to the proper name of this species. Fisher (1928) treats it under the name "*lateralis*" (Say), but this name is unavailable for use due to prior usage for another species. Carlson and Knight (1969) erroneously placed "*lateralis*" in synonymy under *ruficollis* and coined a new name, *browni*, for this species. The confusion was resolved by Bright (1981).

Fisher (1922) gives some information on the life history and habits of this species. Eggs are laid on the bark of the host plant near the ground. After hatching, the larvae bore directly into the bark, progressing downward into the roots where they pass the first winter. The next spring they move into the limbs, making spiral galleries around the limbs and extending upward for a considerable distance. In the fall, the larvae bore into the wood where pupal cells are constructed. Adult emergence begins in the spring of the 3rd year, thus requiring 2 years to complete development. Adults feed on the margins of the leaves of the host plant, causing the leaves to have a ragged appearance.

When attacks are heavy, this species can cause considerable damage. In most instances, however, the larval mines are grown over without any noticeable injury to the plants.

Agrilus difficilis Gory

Fig. 216

Agrilus difficilis Gory, 1841:224; Chamberlin 1926:58; Fisher 1928:38; Craighead 1950:192; Wellso et al. 1976:14.

Agrilus occidentalis Ulher, 1855:416.

Description. Head green in front, becoming purplish or blackish green on vertex; pronotum, scutellum, and elytra greenish black, with a purplish reflection; ventrally coppery, more shining than above. Head wide, flat, with feeble, narrow, longitudinal groove on vertex, a shallow, transverse depression above epistoma and a shallow, round depression on each side behind middle; surface coarsely punctate, slightly rugose, finely granulose; epistoma wide, transverse between antennae, with semicircular emargination in front. Antennae serrate from fourth segment. Pronotum 0.3–0.4 times wider than long, widest near middle; sides weakly, arcuately rounded; disc weakly convex, with shallow, oblique depression on each side along lateral margin, with obsolete impression in front of scutellum, and with arcuate, obtusely rounded, prehumeral carinae, which are connected to marginal carina near middle; surface densely, transversely rugose, finely, sparsely punctate between rugae. Elytra slightly wider at base than just behind middle; sides nearly parallel, weakly, broadly arcuately constricted in front of middle, obliquely attenuate to strongly serrulate, broadly rounded apices; disc slightly flattened, each elytron with two weak, longitudinal costae and a deep oblong, basal depression; surface coarsely punctate. Ventral surface finely, densely punctate, sparsely clothed on median area, densely clothed with yellowish pubescence laterally near anterior margin; pygidium coarsely punctate, with sharply elevated, median carina, which is not projecting; second abdominal sternite not grooved. Tibiae slender, mesotibiae and metatibiae weakly arcuate, all with small tooth on inner margin at apex (♂) or unarmed (♀). Tarsal claws all similar, cleft to middle; teeth acute at apex, equal in length, inner tooth turned inward. Aedeagus as in Fig. 216. Length 7.0–13.0 mm.

Hosts. Reared from honeylocust (*Gleditsia triacanthos*) and southern prickly ash (*Zanthoxylum clavaherculis*); collected on willow (*Salix* spp.).

Distribution. Eastern United States from Texas north to Michigan; not recorded from Canada but almost certainly occurs in southern Ontario.

Comments. According to Fisher (1928), adults of this species are variable in size and color. The upper surface may vary from a greenish black to a purplish tinge under certain conditions. The tarsal claws are variable in that the inner tooth is usually strongly turned inward and nearly touching that of the opposite side but occasionally the tips are widely separated, especially those on the fore tarsi.

Agrilus arbuti Fisher

Agrilus arbuti Fisher, 1928:50; Barr 1971:88.

Description. Head brassy or greenish, feebly brownish on vertex; pronotum brassy or bluish, becoming broadly coppery red on disc; elytra brownish brassy, rarely with weak coppery reflection; ventrally brassy, with distinct coppery tinge. Head wide, weakly convex, usually with narrow, longitudinal groove extending from vertex to middle of frons and a broad, vague impression above epistoma; surface finely, densely granulose and coarsely, irregularly rugose, sparsely punctate between rugae, pubescence sparse; epistoma strongly transverse between antennae, strongly elevated, with deep, arcuate emargination in front. Antennae serrate from fourth segment. Pronotum 0.5 times wider than long, widest near middle; sides weakly arcuate from apical angles to behind middle; disc convex, with broad, vague, anterior and median impression, with broad, deep impression along lateral margin, and sharply defined, short prehumeral carinae; surface densely granulose, deeply, transversely rugose, finely, sparsely punctate between rugae. Elytra about equal in width at base and behind middle; sides nearly parallel or weakly sinuate behind base, weakly, broadly constricted before middle, broadly expanded behind middle, obliquely narrowed to broadly rounded, weakly serrate apices; disc weakly flattened, longitudinal costae absent, with broad, deep, basal impressions; surface finely, densely imbricate-punctate. Ventral surface densely, finely punctate; pygidium not distinctly carinate, sparsely punctate; first and second abdominal sternites not grooved. Tibiae slender, mesotibiae and metatibiae armed with short tooth on inner margin at apex (♂) or unarmed (♀). Tarsal claws all similar, cleft near apex, inner tooth shorter, broader, turned inward, tips separated. Length 5.5-7.5 mm.

Hosts. Reared from manzanita (*Arbutus menziesii*) and *Arctostaphylos* spp. Reported herein from *Amelanchier alnifolia*.

Distribution. Known from California to western Oregon and southern British Columbia.

Canadian record. Creston, B.C., on *Amelanchier alnifolia*.

Comments. This species mines the bark and wood of branches and main trunks of manzanita. In California, the adults fly from May to August and lay their eggs singly on the smooth bark of the branches and trunks. The larvae girdle and kill the branches, causing the formation of large galls. Two years are required to complete a generation.

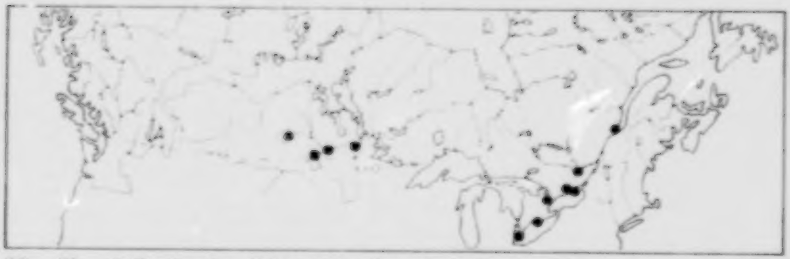
Very little variation is recorded for this species except in size. Adults may be recognized by the distinct prehumeral carinae, by the weakly serrate elytral apices, and by the hosts, in addition to those characters mentioned in the key.

Agrilus masculinus Horn

Fig. 217; Map 58

Agrilus masculinus Horn, 1891:295; Knull 1925:42; Chamberlin 1926:70; Fisher 1928:56; Wellso et al. 1976:14.

Description. Head and antennae bronzy green (♂) or coppery (♀); pronotum bronzy green with brownish or coppery tinge; elytra blackish, with bronzy reflection; ventrally dark bronzy green or coppery. Head wide, nearly flat, with weak, longitudinal, median impression; surface coarsely punctate, finely granulose, somewhat irregularly rugose on frons, longitudinally rugose on vertex; epistoma rather wide between antennae in front. Antennae serrate from fourth segment. Pronotum about 0.4 times wider than long, widest in front of middle; sides weakly, arcuately rounded from apex to middle, then obliquely narrowed to posterior angles; disc moderately convex, with 2 round, distinct impressions at middle, with broad impression along lateral margin, and with sharply defined slightly arcuate, prehumeral carinae extending from base to near middle; surface densely, transversely rugose, finely granulose, with numerous fine punctures between rugae. Elytra about equal in width at base and apical third to broadly subtruncate, finely serrulate apices; disc slightly flattened, with broad, deep, basal impressions;



Map 58. Collection localities of *Agrilus masculinus*.

surface densely, coarsely imbricate-punctate. Ventral surface coarsely punctate, finely granulose on basal segments; pygidium densely, coarsely punctate, indistinctly carinate at middle; first and second abdominal sternites not grooved. Tibiae slender, protibiae and mesotibiae with distinct curved tooth on inner margin at apex (♂) or unarmed (♀). Tarsal claws all similar, cleft at middle, inner tooth broader, turned inward, tips sometimes touching. Aedeagus as in Fig. 217. Length 4.0–6.5 mm.

Hosts. Reared from box-elder (*Acer negundo*), red maple (*Acer rubrum*), and Ohio buckeye (*Aesculus glabra*).

Distribution. Saskatchewan to Quebec, south through the eastern United States to Texas and Mississippi.

Comments. This rather common species is easily distinguished by the characters given in the key. Little variation was encountered in the specimens examined. The pronotum and ventral portion of the body may be more distinctly coppery, the shape and sculpturing of the pronotum varies slightly, and the prosternal lobe may be subtruncate to distinctly emarginate.

Nothing is recorded concerning its biology or life history other than the host plant information given here.

Agrilus paramasculinus Champlain & Knull

Agrilus paramasculinus Champlain and Knull, 1923c:274; Fisher 1928:63.

Description. Similar to *masculinus* but differs in having a more brownish color on upper surface, in having a vague pubescent stripe on each elytron, in having first segment of the posterior tarsi only as long as the following three segments combined, and, in the male, by having long, erect pubescence extending along the middle of the prosternum for its entire length.

Hosts. Kentucky coffeetree (*Gymnocladus dioicus*).

Distribution. Kansas, Missouri, and Michigan; possibly occurs in extreme southwestern Ontario in the range of the host tree. This species is included herein based on a comment by Dr. G. H. Nelson (pers. comm. 1983) "... ex MI (Wellso, in litt.)."

Agrilus arcuatus (Say)

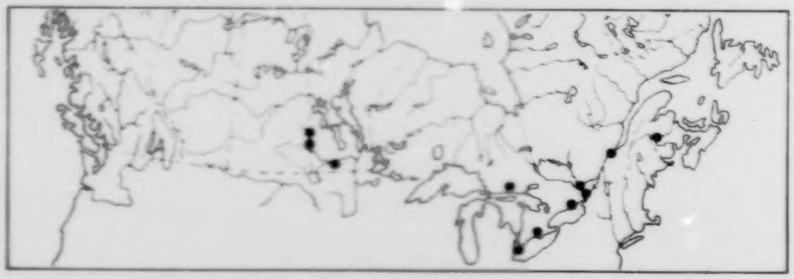
Fig. 218; Map 59

Buprestis arcuata Say, 1825:251.

Agrilus arcuatus: Brooks 1926:331–338; Knull 1925:42; Chamberlin 1926:51; Fisher 1928:63; Craighead 1950:191; Baker 1972:163; Wellso et al. 1976:14.

Agrilus obliquus LeConte, 1860:243.

Description. Head reddish to bluish green; slightly brassy to coppery on vertex (♂) or coppery brown (♀); pronotum bronzy green (♂) to coppery brown (♀); elytra bluish black with a coppery tinge to brassy (♂) or black to coppery red (♀); ventrally brown with brassy reflection. Head wide, flat, with a broad, shallow impression on upper half, becoming distinct, narrow, a longitudinal groove from vertex to middle of frons, and with an obscure impression on each side of frons; surface weakly reticulate, coarsely, irregularly punctate between rugae; epistoma strongly transverse between antennae, deeply, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum 0.4 times wider than long, widest at middle; sides evenly, arcuately rounded from apical angles to base; disc moderately convex, concave along base, an impression extending along lateral margins to near apical angles, with broad, shallow, median impression near anterior margin, and with sharply defined, arcuate, prehumeral carinae; surface coarsely, irregularly rugose, finely punctate between rugae. Elytra about equal in width at base and behind middle; sides broadly, arcuately constricted in front of middle, broadly expanded behind middle, then narrowed to the broadly rounded, serrulate apices; disc flattened along sutural margins, with broad, deep, basal impressions; surface finely, densely imbricate-punctate. Ventral surface densely,



Map 59. Collection localities of *Agrilus arcuatus*.

obsoletely granulose, rather densely, finely punctate; pygidium coarsely, densely punctate and weakly, longitudinally carinate at middle, carina not projecting; first abdominal sternite weakly flattened at middle (♂) or not flattened (♀). Tibiae slender, protibiae and mesotibiae armed with long, distinct tooth on inner margin at apex (♂) or with very short tooth on inner margin (♀). Tarsal claws all similar, cleft near middle, inner teeth turned inward, tips touching. Aedeagus as in Fig. 218. Length 6.0–7.5 mm.

Hosts. Reared from black oak (*Quercus velutina*), white oak (*Q. alba*), beech (*Fagus americana*), American chestnut (*Castanea dentata*), American hazel (*Corylus americana*), and hickory (*Carya* spp.).

Distribution. Manitoba to New Brunswick, south throughout the eastern United States.

Comments. This species is a complex that Fisher (1928) divides into four subspecies based on coloration and on species of host plants attacked. For simplicity, I am not using the subspecies designation in this work. For readers information the subspecies are as follows: *fulgens* LeConte—feeds on *Corylus americana*, recorded from Ontario and Minnesota south to Virginia; *torquatus* LeConte—feeds on *Carya* and pecan, recorded from eastern United States; *coryli* Horn—feeds on *Corylus americana*, recorded from Maine to Maryland, east to Iowa; and *arcuatus*—feeds on *Fagus* and *Castanea*, recorded from the eastern North America.

Brooks (1926) reported on the biology of *A. arcuatus* and the following is taken from his account. Adults appear in the spring, from May to July, and feed on the leaves of white oak, causing large irregular holes. Eggs are laid singly on the bark surface or near the base of a small shoot or twig of the current summer's growth. The larvae feed beneath the bark during the summer and, during the fall, they sever the wood by constructing a spiral gallery. Winter is passed in the larval stage. The next spring, they continue to feed beneath the bark, making large, irregular, long galleries. When full-grown, they make a second spiral cut around the wood. They then mine upward in the phloem for several centimetres and construct a pupal cell in the pith. Two years are required to complete a generation. Considerable damage may occur to trees in nurseries of nut-tree orchards, by the pruning off of small branches and terminals.

Adults of this species are variable in color, with the head and pronotum ranging from coppery red to coppery brown to brassy, with the elytra black to violet or with bluish or coppery tinge. Sometimes the male and female are similar in color.

Agrilus crinicornis Horn

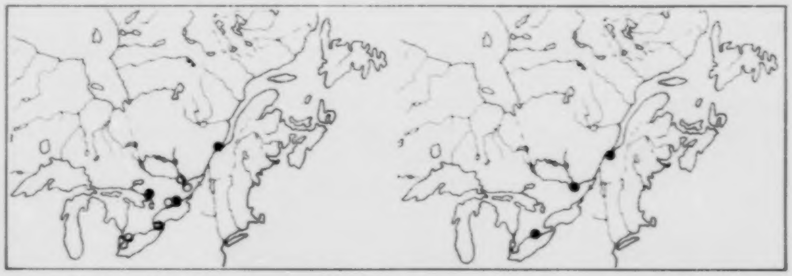
Figs. 44, 219; Map 60

Agrilus crinicornis Horn, 1891:294; Knull 1925:42; Chamberlin 1926:58; Fisher 1928:72; Wellso et al. 1976:14.

Description. Head blue to greenish blue, becoming brassy on occiput (♂) or coppery brown or brassy (♀); pronotum bronzy brown to black at middle, bronzy green or blue laterally; elytra black, with weak bronze or greenish reflections; ventrally black, with a weak bronzy tinge. Head wide, flat (♂) or slightly convex (♀), with obsolete, longitudinal, median impression; surface densely, finely granulose, with several coarse punctures, weakly rugose on vertex; epistoma broadly, arcuately emarginate in front, not transverse between antennae. Antennae serrate from fourth segment, all segments clothed with long, sparse, white setae on underside (♂) (Fig. 25), or without long setae ventrally (♀). Pronotum 0.3 times wider than long, widest along apical half; sides subparallel from apical angles to middle, then obliquely narrowed to basal angles; disc moderately convex, with 2 broad, deep impressions longitudinally at middle, with deep, broad impression along lateral margin from apical fourth to base, and with indistinct prehumeral carinae; surface densely, finely granulose, transversely rugose on disc, with fine, sparse punctures between rugae. Elytra about equal in width at base and apical third; sides weakly, broadly constricted in front of middle, expanded near apical third, then obliquely narrowed to finely serrulate, broadly rounded apices; disc slightly flattened, with broad, deep, basal impressions but without distinct, longitudinal costae; surface densely, coarsely imbricate-punctate. Ventral surface sparsely, finely punctate, weakly granulose on basal segments, punctate toward apex; pygidium sparsely, coarsely punctate, not longitudinally carinate; first and second abdominal sternites flattened, not grooved or pubescent at middle (♂) or convex at middle (♀). Tibiae slender, straight, all three pairs armed with long tooth on inner margin at apex (♂) or unarmed at apex (♀). Tarsal claws all similar, cleft near middle, inner tooth turned inward, tips sometimes touching. Aedeagus as in Fig. 219. Length 4.0–6.0 mm.

Hosts. Unknown. Adults have been collected on the leaves of red raspberry (*Rubus* spp.) and oak (*Quercus* spp.).

Distribution. Ontario and Quebec, and in the eastern United States from Maine to Virginia, west to Ohio and Wisconsin.



Maps 60, 61. 60, Collection localities of *Agrilus crinicornis* (•) and *A. defectus* (○); 61, *A. geminatus*.

Comments. Fisher (1928) reports that this species is rather uniform in size but varies greatly in color. The head varies from brilliant dark blue to bronzy or greenish blue and the median portion of the pronotum varies from bronzy brown to nearly black, laterally varying from blue to bronzy green. Slight variation occurs in the shape and sculpturing of the pronotum, and the elytra sometimes have vaguely indicated longitudinal costae.

Males of this species are easily recognized by the long antennae, which are longer than the pronotum and bear long setae on the ventral side (Fig. 44). Females are difficult to distinguish from those of *otiosus* and allied species.

Agrilus defectus LeConte

Fig. 220; Map 60

Agrilus defectus LeConte, 1860:244; Knull 1925:41; Chamberlin 1926:58; Fisher 1928:75; Wellso et al. 1976:14.

Description. Head bronzy green or purplish black to greenish blue (♂) or coppery red (♀); pronotum brown, with coppery tinge; elytra brownish black, with weak brassy reflection; ventrally black, with greenish or brassy reflection. Head wide, weakly convex, with vague longitudinal groove on vertex and occiput; surface finely, distinctly granulose, more so in male, sparsely, coarsely punctate, finely rugose above epistoma, pubescence sparse (♀) or dense on lower half (♂); epistoma slightly transverse between antennae, broadly, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.3 times wider than long, widest along apical half; sides nearly parallel or weakly sinuate from apical angles to middle, then narrowed to posterior angles; disc moderately convex, with 2 broad, shallow impressions arranged longitudinally at middle, with moderately deep, broad impression along lateral margin from apical fourth to base, and with obsolete prehumeral carinae; surface finely reticulate. Elytra about equal in width at base and apical third; sides broadly constricted in front of middle, arcuately expanded at apical third, then obliquely narrowed to broadly rounded or subtruncate, coarsely serrate apices; disc weakly convex, with broad, shallow, basal impressions and with only a vague trace of longitudinal costae; surface coarsely imbricate-punctate anteriorly, becoming smoother toward apex. Ventral surface densely, finely granulose, coarsely punctate on basal segments; pygidium sparsely, coarsely punctured, with vague longitudinal carina, carina not projecting beyond posterior margin; first and second abdominal sternites weakly flattened at middle (♂) to convex (♀). Tibiae slender, straight, all three pairs with distinct tooth on margin at apex (♂) or unarmed at apex (♀). Tarsal claws all similar, cleft near middle, inner tooth turned inward, tips sometimes touching. Aedeagus as in Fig. 220. Length 3.5–5.0 mm.

Hosts. Reared from branches of white oak (*Quercus alba*).

Distribution. Southern Ontario and Quebec through the northeastern United States, east to Iowa and Oklahoma, south to Mississippi.

Comments. Adults of this species vary somewhat in color and in pronotal sculpture. The front of the head in males varies from bronzy green to purplish black, more greenish blue laterally. The median pronotal impressions vary in depth and may be only weakly indicated.

This species is frequently confused with *otiosus* but the males of *defectus* are readily distinguished by the truncate last abdominal segment, which bears a dense fringe of long setae at the apex. In the females of *defectus*, these setae are much less conspicuous and may be nearly obsolete.

Agrilus cliftoni Knull

Fig. 221

Agrilus cliftoni Knull, 1941:382; Wellso et al. 1976:14.

Description. Head, pronotum, and legs bronzy green; elytra black, with bronzy reflection; ventrally dark bronze. Head convex, with slight median impression on vertex; surface granulose on frons, vertex coarsely punctate. Antennae serrate from fourth segment. Pronotum wider than long, widest in front of middle; sides arcuately rounded in front, then obliquely narrowed to base; disc convex, with 2 median, transverse impressions, with lateral impression on each side, and with prehumeral carinae well-developed; surface densely, transversely rugulose, with fine punctures between rugae. Elytra at base wider than base of pronotum; sides parallel at base, constricted before middle, apices rounded, serrulate; disc convex, with prominent basal impressions and with obsolete costae laterally; surface imbricate, pubescence not distinct. Ventral surface coarsely punctate; pygidium without projecting carina; first two abdominal sternites slightly flattened. Tibiae slender, straight, protibiae and metatibiae armed with distinct tooth on inner margin at apex. Aedeagus as in Fig. 221. Length 5.7 mm.

Hosts. Reared from black walnut (*Juglans nigra*).

Distribution. Ohio, Michigan, and Arkansas. Not recorded from Canada but may occur in southern Ontario.

Comments. This species is included here because of Wellso et al.'s inclusion of this species in their key to Michigan buprestids. No specimens have been seen and the diagnosis is taken from the original description of the male by Knull (1941). Knull (1941) states that this species resembles *masculinus* in size, form, and color, but that it would key out in Fisher's (1928) key to *arcuatus*. The species is placed in the current key based on Wellso et al.'s placement.

Agrilus geminatus (Say)

Fig. 222; Map 61

Buprestis geminata Say, 1823:163.

Agrilus geminatus: Chamberlin 1926:63; Fisher 1928:78; Wellso et al. 1976:14.

Description. Head brilliant blue to greenish blue, slightly brassy on vertex; pronotum bluish green at middle, more greenish toward sides; elytra black, with weak violet tinge; ventrally dark bronzy green. Head wide, nearly flat, with obsolete, longitudinal groove extending from vertex to middle of frons; surface densely granulose, rather densely, coarsely punctate, longitudinally rugose on vertex; epistoma transverse between antennae, broadly, shallowly emarginate in front. Antennae serrate from fourth segment. Pronotum 0.3 times wider than long, widest along apical half; sides parallel from apical angles to middle, then arcuately narrowed to posterior angles; disc convex, with 2 round, deep impressions arranged longitudinally at middle, with broad, oblique impression along lateral margins, and with short, obsolete prehumeral carinae; surface finely, densely granulose, weakly, transversely rugose, with numerous coarse punctures between rugae. Elytra about equal in width at base and just behind middle; sides parallel for a short distance behind base, broadly, arcuately constricted in front of middle, broadly expanded behind middle, then obliquely narrowed to the narrowly rounded, strongly serrulate apices; disc slightly flattened, with broad, moderately deep, basal impressions, and with obsolete longitudinal costae laterally; surface densely, strongly imbricate-punctate. Ventral surface obscurely reticulate, finely punctate; pygidium sparsely, coarsely punctate, without distinct median carina; first and second abdominal sternites weakly flattened at middle (♂) or convex at middle (♀). Tibiae slender, straight, with short tooth on inner margin at apex (♂) or unarmed at apex (♀). Tarsal claws all similar, cleft near middle, inner tooth broader, turned inward, tips sometimes touching. Aedeagus as in Fig. 222. Length 3.7–5.0 mm.

Hosts. Recorded from oak (*Quercus* spp.).

Distribution. Ontario and Quebec, south to Texas and Virginia.

Comments. Adults of this species are variable mainly in coloration. In the males, the front of the head varies from brilliant blue to bluish green, the pronotum sometimes is more uniformly green, and the elytra may have a weak violet reflection. Structural features may also vary. In some specimens, the sides of the pronotum may be strongly sinuate anteriorly or the pronotum may be widest at the middle and the sides arcuately rounded, the median impressions on the pronotum vary in depth and may be only weakly indicated, and the prehumeral carina varies from obsolete to distinctly visible.

The females of this species cannot be readily separated from those of *otiosus*, *defectus*, or related species.

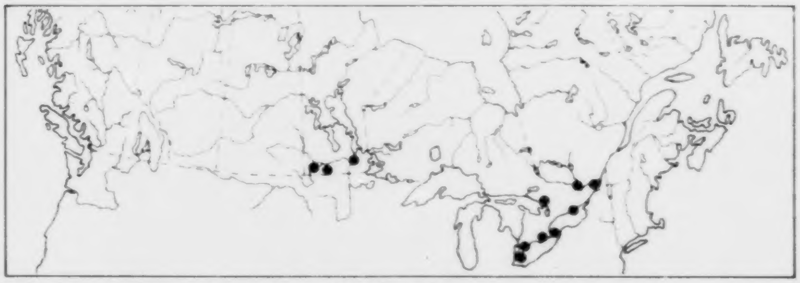
Agrilus otiosus Say

Fig. 223; Map 62

Agrilus otiosus Say, 1839:163; Knull 1925:40; Chamberlin 1926:74; Fisher 1928:81; Wellso et al. 1976:14.

Agrilus virens Gory, 1841:259.

Description. Head and antennae blue to greenish blue (♂) or head brassy (♀); pronotum dark bronzy green, bluish, greenish or brassy laterally; elytra black, with strong greenish or bronzy tinge; ventrally dark bronzy green. Head wide, nearly flat (♂) or slightly convex (♀), without distinct impressions; surface rather densely, coarsely punctate dorsally, finely granulose, and longitudinally rugose on vertex, densely clothed on lower half with long, white setae (♂) or pubescence absent or sparse (♀); epistoma strongly transverse between antennae, broadly, not deeply, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.2 times wider than long, widest along apical half; sides nearly parallel from apical angles to just behind middle, then obliquely narrowed to posterior angles; disc moderately convex, with 2 round, weak impressions arranged longitudinally at middle, with broad, oblique impression laterally near middle, and with distinct, short, straight prehumeral carinae; surface coarsely, transversely rugose, with numerous fine punctures between rugae. Elytra slightly wider at base than behind middle; sides broadly, weakly constricted in front of middle, arcuately narrowed to the broadly rounded, serrulate apices; disc slightly flattened, with broad, moderately deep basal impressions, and with obsolete longitudinal costae on each side; surface densely imbricate-punctate. Ventral surface finely, rather densely punctate; pygidium sparsely, coarsely punctate, median carina weakly elevated, not projecting; first and second abdominal sternites weakly flattened at middle (♂) or weakly convex at middle (♀). Tibiae straight, slender, armed with small tooth on inner margin at apex (♂) or unarmed at apex (♀). Tarsal claws all similar, cleft near middle, inner tooth broader, turned inward, tips sometimes touching. Aedeagus as in Fig. 223. Length 4.0-5.7 mm.



Map 62. Collection localities of *Agrilus otiosus*.

Hosts. Reared from hickory (*Carya* spp.).

Distribution. Manitoba to Quebec, southward through the eastern United States to Mississippi and Alabama.

Comments. Adults of this species vary considerably in coloration. In the males, the front of the head varies from deep blue to greenish blue, the middle of the pronotum varies from bronzy green to bronzy brown, with the sides greenish, bronzy or bluish, and sometimes the elytra have a greenish or bronzy tinge. In addition, the median impressions on the pronotum vary from scarcely to deeply impressed. Other slight structural variations are also evident.

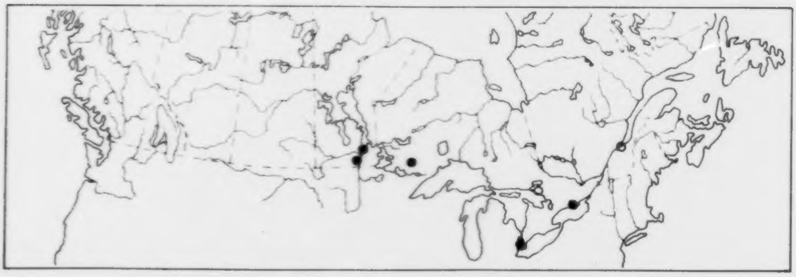
As with the preceding species, females cannot be adequately distinguished from those of allied species. Males may be distinguished from related species by the presence of a distinct tooth at the apex of all tibiae, by the antennae being shorter than the pronotum, by the last abdominal sternite being not fimbriate at the apex, by the conspicuously pubescent prosternum, by the densely pubescent front of the head, and by the aedeagus (Fig. 203).

Agrilus atricornis Fisher

Fig. 224; Map 63

Agrilus atricornis Fisher, 1928:86; Wellso et al. 1976:14.

Description. Head dark blue, with a weak greenish tinge (♂), or brassy green with a coppery brown tinge (♀); antennae bluish black; pronotum dark brown, slightly brassy laterally; elytra uniformly brownish black; ventrally black with a weak brassy reflection. Head wide, weakly convex (♂) to strongly convex (♀), with a vague longitudinal groove extending from vertex to middle of frons; surface densely granulose, coarsely, sparsely punctate, transversely rugose behind epistoma, sparsely clothed on lower half with long,



Map 63. Collection localities of *Agrilus atricornis* (○) and *A. frosti* (•).

white setae, pubescence short in female; epistoma transverse between antennae, broadly, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.25 times wider than long, widest along apical half; sides nearly parallel from apical angles to middle, then obliquely narrowed to posterior angles; disc moderately convex, with 2 round, shallow depressions arranged longitudinally at middle, with broad, deep, oblique impression along lateral margin, and with short, weakly elevated prehumeral carinae; surface densely, finely granulose, weakly, transversely rugose with numerous, coarse punctures between rugae. Elytra about equal in width at base and just behind middle; sides parallel behind base, broadly, arcuately constricted in front of middle, expanded behind middle, then obliquely narrowed to narrowly rounded, weakly serrulate apices; disc slightly flattened, with broad, moderately deep, basal impressions, and with an obsolete longitudinal costa on each side; surface densely, coarsely punctate. Ventral surface obsoletely reticulate, finely punctate, sparsely clothed with short, recumbent, white setae; pygidium coarsely, sparsely punctate, with a vague longitudinal, not projecting carina; first and second abdominal sternites vaguely, longitudinally flattened at middle (♂) or convex at middle (♀). Tibiae slender, straight, all three pairs armed with distinct tooth on inner margin at apex (♂) or unarmed at apex (♀). Tarsal claws all similar, cleft near middle, inner tooth broader, turned inward, tips sometimes touching. Aedeagus as in Fig. 224. Length 4.0–5.0 mm.

Hosts. Recorded only from beaked hazelnut (*Corylus cornuta*).

Distribution. Ontario and Quebec, through the eastern United States.

Comments. Adults of this species are rather uniform in coloration, although the head and pronotum of the female varies from bronzy green to bronzy coppery. As with related species, the structural features of the pronotum and elytra vary in degree of distinctness.

Nothing is known of the habits of this species except that adults were collected on *Corylus cornuta*.

Agrilus transimpressus Fall

Fig. 225

Agrilus transimpressus Fall, 1925:181; Chamberlin 1926:84; Fisher 1928:88; Wellso et al. 1976:14.

Description. Head bright blue to dark bronzy green; pronotum bronzy brown at middle, becoming greenish toward sides; elytra black, with weak greenish or brassy tinge. Head wide, weakly convex (♂) or more strongly convex (♀), devoid of longitudinal groove or impressions; surface densely granulose, coarsely, densely punctate, rugose on vertex, anteriorly with long, recumbent, white pubescence nearly concealing surface; epistoma weakly transverse between antennae, not elevated, with a shallow, arcuate emargination at middle. Antennae serrate from fourth segment. Pronotum about 0.3 times wider than long, widest at middle; sides arcuate from apical angles to behind middle, strongly obliquely narrowed to posterior angles; disc moderately convex, with two broad, vague, median impressions, one before scutellum, other at apical third, with broad, shallow impression along lateral margin and with short, weakly indicated prehumeral carinae; surface densely, finely granulose, vaguely transversely rugose, finely, sparsely punctured between rugae. Elytra about equal in width at base and behind middle; sides parallel for short distance behind base, very broadly, weakly constricted before middle, broadly expanded behind middle, then obliquely narrowed to broadly rounded, finely serrate apices; disc weakly flattened, without longitudinal costae, with broad, shallow, basal impressions; surface densely, coarsely, imbricate-punctate. Ventral surface obsoletely granulose, sparsely, finely punctate, sparsely clothed with moderately long, recumbent, fine setae; pygidium sparsely, coarsely punctate, not longitudinally carinate; first abdominal sternite broadly, longitudinally impressed (♂) or convex (♀); second abdominal sternite broadly, transversely concave (♂ only). Tibiae slender, straight, all three pairs armed with long, slender tooth on inner margin at apex (♂) or unarmed at apex (♀). Tarsal claws all similar, cleft near middle, inner tooth broader, turned inward, tips touching. Aedeagus as in Fig. 225. Length 4.5-6.0 mm.

Hosts. Recorded from black walnut (*Juglans nigra*).

Distribution. Eastern United States from Michigan to Mississippi; not yet recorded from Canada but to be expected in southern Ontario.

Comments. The males of this species are easily separated from allied species by the transversely concave second abdominal sternite; females cannot be distinguished from allied species. The front of the head in the male may vary from bright blue to bronzy green, the sides of the pronotum may be parallel on the anterior half, and the median impressions may be moderately deep.

Nothing is recorded of the habits or life history of this species.

Agrilus osburni Knull

Agrilus osburni Knull, 1937:38; Wellso et al. 1976:14.

Description (♂). Head, antennae, sides of pronotum, and legs green; elytra black, remainder dark bronze with brassy reflection. Head convex, median impression faint; surface granulose in part, rugose on vertex, lower half clothed with recumbent, white setae. Antennae serrate from fourth segment. Pronotum wider than long, widest in middle; sides broadly arcuate anteriorly, narrowed to base; disc convex, with 2 broad, indistinct median impressions, lateral impressions deep, and with prominent prehumeral carinae; surface transversely rugose. Elytra at base wider than base of pronotum; sides parallel near base, constricted before middle, then broadly rounded on apical half to the broadly rounded, serrulate apices; disc convex, with deep, basal impressions; surface imbricate-punctate. Ventral surface densely, finely punctate; pygidium sparsely, coarsely punctate, median carina weakly elevated, not projecting; first two abdominal sternites longitudinally impressed. Tibiae slender, all three pairs armed with slender tooth on inner margin near apex. Tarsal claws all similar, cleft near middle, inner tooth broad, turned inward, tips nearly touching. Length 5.0 mm.

Hosts. Known only from eastern hop hornbeam (*Ostrya virginiana*).

Distribution. Ohio, Michigan; not recorded from Canada but to be expected in southern Ontario.

Comments. This species was described from two males and the above diagnosis was taken from that description. No specimens have been seen.

Although this species has not yet been taken in Canada, the host tree given in Wellso et al. (1976) (hop hornbeam) occurs in southeastern Manitoba, southern Ontario, and Quebec and in the Maritime Provinces. The species should be looked for in those localities.

Knull (1937) states that this species resembles *juglandis*, but *osburni* is distinguished by the median impression on the first two ventral sternites of the abdomen.

Nothing is known of the habits or life history of this species.

Agrilus frosti Knull

Fig. 226; Map 63

Agrilus frosti Knull, 1920:8; Knull 1925:41; Chamberlin 1926:65; Fisher 1928:90; Wellso et al. 1976:14.

Description. Head blue to green, brassy coppery on occiput (♂) or bronzy to brownish with coppery tinge (♀); antennae green; pronotum bronzy green laterally; elytra black, with vague purplish reflection; ventrally dark bronzy green. Head wide, slightly convex (♂) to strongly convex (♀), median depression absent; surface finely, densely granulose, coarsely, densely punctate, slightly rugose behind epistoma, sparsely clothed on lower half with long, semierect, white setae, more sparsely pubescent in female; epistoma transverse between antennae, weakly, broadly emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.5 times wider than long, widest near middle; sides nearly parallel or weakly sinuate from apical angles to middle, then obliquely narrowed to posterior angles; disc moderately convex, with 2 round, distinct impressions arranged longitudinally at middle, with broad, deep impression laterally, and with weakly indicated prehumeral carinae; surface coarsely, densely, transversely rugose, finely, densely granulose, with numerous fine punctures between rugae. Elytra about equal in width at base and apical third; sides broadly, arcuately constricted in front of middle, arcuately narrowed from apical third to broadly rounded, weakly serrulate apices; disc weakly convex, with broad, shallow, basal impressions; surface densely imbricate-granulate. Ventral surface coarsely, densely punctate, finely granulose basally, sparsely, finely punctate toward apex, sparsely clothed with short, recumbent, whitish setae; pygidium sparsely, coarsely punctate, not longitudinally carinate; first and second abdominal sternites weakly, broadly, longitudinally flattened (♂) or convex at middle (♀). Tibiae slender, anterior pair weakly arcuate, all three pairs armed with long tooth on inner margin near apex (♂) or unarmed at apex (♀). Tarsal claws all similar, cleft near middle, inner tooth broader, turned inward, tips sometimes touching. Aedeagus as in Fig. 226. Length 3.7–5.5 mm.

Hosts. Recorded from oak (*Quercus* spp.).

Distribution. Southern Manitoba and southern Ontario, south to North Carolina.

Comments. The head varies from bright blue to bronzy green in the male and from bronzy coppery to dark brownish coppery in the female. Structural features that vary are the depth of the median impressions on the pronotum and the elevation of the prehumeral carinae, but this elevation is never as sharp as in *juglandis*, and sometimes may be absent.

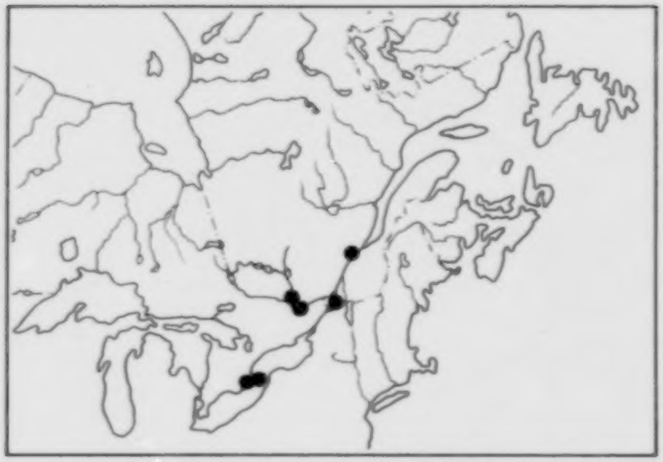
Adults of *frosti* closely resemble those of *otiosus*, but the absence of conspicuous pubescence on the prosternum of the male *frosti* distinguish it. The aedeagus of *frosti* (Fig. 226) is also different from that of *otiosus* and of *juglandis* (Figs. 223, 227), being strongly, arcuately expanded near the apex; in both *otiosus* and *juglandis* the sides are nearly parallel at the apex. The females cannot be adequately distinguished.

Agrilus juglandis Knull

Fig. 227; Map 64

Agrilus juglandis Knull, 1920:7; Knull 1925:40; Chamberlin 1926:67; Fisher 1928:93; Craighead 1950:192; Wellso et al. 1976:14.

Description. Head green, brassy coppery on occiput (♂) or entirely brassy coppery (♀); antennae green; pronotum bronzy green, slightly more greenish laterally; elytra black, with weak brassy tinge; ventrally black, with weak brassy or greenish tinge. Head wide, slightly convex (♂) to strongly convex (♀), with an obsolete, longitudinal, median depression; surface coarsely, sparsely punctate, finely, densely granulose, somewhat rugose behind vertex, densely clothed on lower half with moderately long, semierect, white pubescence (♂), more sparsely pubescent in female; epistoma strongly transverse between antennae, deeply, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.4 times wider than long, widest just behind middle; sides obliquely arcuate from apical angles to behind middle, then obliquely narrowed to posterior angles; disc moderately convex, with 2 broad, indistinct impressions arranged longitudinally at middle, with deep, broad impression along lateral margin from apical fourth to base, and with sharply defined, straight prehumeral carinae; surface coarsely, densely, transversely rugose, finely, densely granulose, with numerous, fine punctures between rugae. Elytra about equal in width at base and apical third; sides parallel behind base, broadly constricted before middle, broadly rounded



Map 64. Collection localities of *Agrilus juglandis*.

at apical third, then obliquely narrowed to broadly rounded, weakly serrulate apices; disc weakly convex, with broad, moderately deep basal impressions, and without distinct costae, surface densely imbricate-punctate. Ventral surface vaguely granulose, rather coarsely, densely punctate basally, more finely, sparsely punctate toward apex, sparsely clothed with short, recumbent, whitish setae; pygidium sparsely, coarsely punctate, median carina weakly elevated, not projecting; first and second abdominal sternites convex, not impressed at middle. Tibiae slender, straight, all three pairs armed with distinct tooth on inner margin at apex (♂) or unarmed at apex (♀). Tarsal claws all similar, cleft near middle, inner tooth broader, turned inward, tips sometimes touching. Aedeagus as in Fig. 227. Length 4.5–6.0 mm.

Hosts. Known only from butternut (*Juglans cinerea*).

Distribution. Southern Ontario and southern Quebec, south to Virginia.

Comments. Adults of *juglandis* are rather uniform in color. The pronotum is sometimes widest along anterior half with the margins nearly parallel or slightly sinuate, the median impressions are variable in depth, and other structural features vary slightly.

This species is related to *frosti*, but in the males of *juglandis* the first and second abdominal sternites are not longitudinally flattened and the aedeagus is strongly, arcuately expanded at the middle, with parallel sides toward the apex (Fig. 207).

The larvae of this species feed in the outer bark of living butternut trees.

Agrilus vittaticollis (Randall)

Fig. 228; Map 65

Buprestis vittaticollis Randall, 1838:38.
Agrilus vittaticollis: Knull 1925:43; Chamberlin 1926:85; Fisher 1928:104; Craighead 1950:192; Barr 1971:87; Wellso et al. 1976:14.

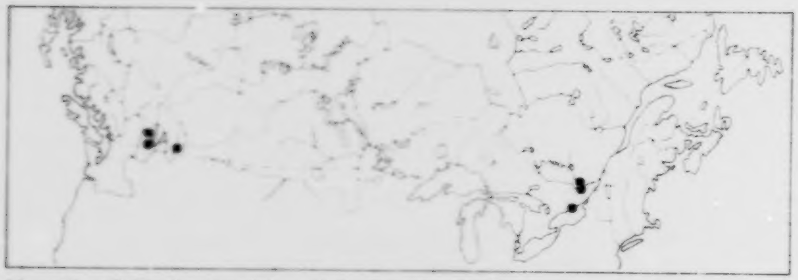
Description. Head and pronotum purplish red, sometimes with brassy tinge; elytra black; ventrally black, with strong purplish tinge. Head wide, vertex broadly concave, occiput more deeply impressed, concavity extending to lateral margins and with narrow, longitudinal groove extending from vertex to epistoma; surface finely, closely rugose, densely, finely punctate, densely clothed with long, recumbent, golden yellow setae except on vertex and along upper half of eyes; epistoma wide between antennae, broadly, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.5 times wider than long, widest at middle; sides strongly, arcuately rounded; disc moderately convex, with broad, shallow, median impression on each side along lateral margin, without prehumeral carinae; surface closely, coarsely rugose, rugae oblique anteriorly, transverse near base, finely punctate between rugae, with median band of golden pubescence extending from base to anterior margin, and broader band of similar pubescence along lateral margins. Elytra about equal in width at base and apical third; sides parallel behind base, broadly constricted before middle, broadly rounded at apical third, then obliquely narrowed to broadly rounded, strongly serrulate apices; disc flattened, without trace of costae, basal impressions deep; surface finely, densely imbricate-punctate. Ventral surface finely punctate and granulose, rather densely clothed with short, recumbent, white setae; pygidium coarsely punctate, strongly carinate, carina projecting and truncate at apex; first abdominal sternite slightly flattened and rugose at middle, second with weak longitudinal impression (♂) or first two segments convex at middle (♀). Tibiae slender, weakly arcuate, all three pairs with strong tooth on inner margin at apex (♂) or unarmed at apex (♀). Tarsal claws dissimilar, anterior one cleft near tip, middle one slightly more deeply cleft, and posterior ones cleft near middle, teeth about equal in width, inner teeth weakly turned inward but tips widely separated (♂) or tarsal claws similar on all legs, cleft near middle (♀). Aedeagus as Fig. 228. Length 8.0–9.7 mm.

Hosts. Known from serviceberry (*Amelanchier canadensis*), hawthorn (*Crataegus* spp.), apple, pear, wild cherry (*Pyrus* spp., and *Malus* spp.), and chokecherry (*Prunus virginiana*).

Distribution. British Columbia to Ontario and Quebec, south throughout most of the United States.

Comments. This species is easily distinguished by the characters given in the key. It cannot be confused with any other Canadian species.

The larvae attack the roots and lower trunk of the host plants indicated here.



Map 65. Collection localities of *Agrilus vittaticollis*.

anxius complex

The species formerly known as *Agrilus anxius* has been reported as breeding in a number of species of birch and poplar (Fisher 1928). More recent detailed studies of the biology of the various forms occurring in the different host trees have shown that specimens reared from or attracted to birch and poplar were separable by characters of their male genitalia. Barter and Brown (1949) reported on their studies and described one new species, *liragus*. Carlson and Knight (1969), in a detailed and thorough study of the entire *anxius* complex, made a number of taxonomic changes.

The following key separates the more typical members of each species or subspecies, but it must be realized that because of the variability of the forms in this complex, all specimens cannot be adequately placed. Knowledge of host plant and locality will aid in separating some doubtful specimens.

Key to species in the *anxius* complex

1. Dorsally dark coppery red, frequently with purple reflections; on alder and birch; Manitoba to Nova Scotia, south to Pennsylvania and New Jersey .... ***pensus* Horn** (p. 257)
   Dorsally blackish with greenish or plumbeous reflection, head and pronotum sometimes with coppery reflections, elytra never with coppery reflections 2
2. Head flattened in profile; elytral pubescence recumbent, evenly distributed, short, uniform in length; elytral disc smooth, finely imbricate, and usually lacking distinct longitudinal costae; on roots of poplar; Manitoba east to Massachusetts, south to Arizona .... ***horni* Kerremans** (p. 258)
   Head convex in profile; elytral pubescence not uniform in distribution or length; elytral disc more coarsely imbricate and often with longitudinal costae 3
3. Pronotum and vertex in the male or entire head in the female, with coppery or brassy reflections, these sometimes lost in museum specimens, elytra greenish black; lateral lobes of aedeagus less narrowed apically and more bluntly pointed ventrally, inner margin of each lobe much wider (Fig. 229); on birch; Newfoundland to British Columbia, south to New Jersey, Ohio, and Colorado .... ***anxius* Gory** (p. 255)

Pronotum and head nearly always without coppery reflections, but if with reflections, these never distinct, elytra black usually with coppery reflections or with pubescent spots; lateral lobes of aedeagus more strongly narrowed and less bluntly pointed ventrally, inner margin of each lobe narrower (Figs. 230, 231); on poplar 4

4. Elytra blackish with indistinct coppery reflection, without spots or with pair of indistinct spots at basal third; New Brunswick to British Columbia .... *liragus* **Barter & Brown** (p. 259)

Elytra coppery, greenish or bluish, usually with up to 6 weakly indicated golden to whitish pubescent spots 5

5. Front of head densely pubescent, setae nearly obscuring surface; elytral tips rather broadly rounded 6

Front of head not densely pubescent, surface distinctly visible; elytral tips acute or narrowly rounded; South Dakota, Michigan .... *quadriguttatus* **Gory** (p. 260)

6. Eastern form, occurring as far west as Idaho (?) and Montana; elytra dark, with white or golden pubescent spots ... ***granulatus granulatus*** **(Say)** (p. 261)

Western form, occurring from British Columbia to southwestern Alberta and Montana; elytra coppery to greenish or bluish, often with whitish pubescent spots .... ***granulatus populi*** **Fisher** (p. 261)

Tableau des espèces du complexe *anxius*

1. Surface dorsale cuivré foncé, souvent avec des reflets violets; sur l'aulne et le bouleau; Manitoba jusqu'à la Nouvelle-Écosse, au sud jusqu'à la Pennsylvanie et le New Jersey .... *pensus* **Horn** (p. 257)

Surface dorsale noirâtre avec des reflets verdâtres ou plombés, tête et pronotum parfois avec des reflets cuivrés, les élytres sans reflets cuivrés 2

2. Tête aplatie vue de profil; pubescence des élytres couchée, uniformément répartie, courte et de longueur uniforme; disque des élytres lisse, finement imbriqué, et généralement sans costa longitudinale distincte; sur les racines de peuplier; du Manitoba vers l'est jusqu'au Massachusetts et au sud en Arizona .... *horni* **Kerremans** (p. 258)

Tête convexe vue de profil; répartition ou longueur de la pubescence sur les élytres non uniforme; disque des élytres plus grossièrement imbriqué et souvent avec une costa longitudinale 3

3. Pronotum et vertex chez le mâle ou la tête entière chez la femelle, avec des reflets cuivrés ou jaunes, parfois perdus chez les spécimens préservés, élytres noir verdâtre; lobes latéraux de l'édéage moins rétrécis à l'apex et plus acuminés ventralement, la marge interne de chaque lobe beaucoup plus large (fig. 229); sur le bouleau; Terre-Neuve jusqu'à la Colombie-Britannique, sud jusqu'au New Jersey, l'Ohio, et le Colorado .... *anxius* **Gory** (p. 255)

Pronotum et tête presque toujours sans reflets cuivrés, mais si présent, les reflets jamais distincts, élytres noirs généralement avec des reflets cuivrés ou avec des taches pubescentes; lobes latéraux de l'édéage plus fortement rétrécis et moins acuminés ventralement, la marge interne de chaque lobe plus étroite (fig. 230, 231); sur le peuplier 4

4. Élytres noirâtres avec des reflets cuivrés peu distincts, sans taches ou avec une paire de taches peu distinctes sur le tiers basal; Nouveau-Brunswick jusqu'à la Colombie-Britannique .... *liragus* **Barter & Brown** (p. 259)

Élytres cuivrés, verdâtres ou bleuâtres, généralement avec jusqu'à 6 taches peu distinctes formées d'une pubescence dorée à blanchâtre 5

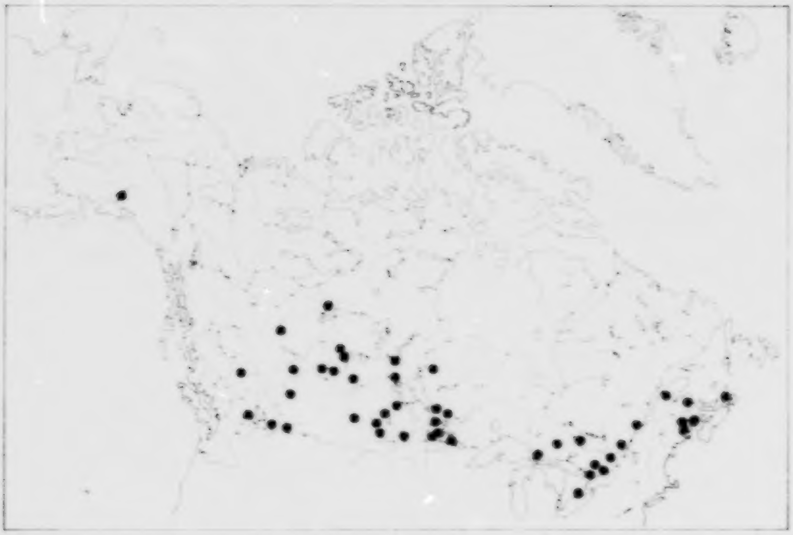
5. Front densément pubescent, soies obscurant presque la surface; apex de chaque élytre plutôt largement arrondi 6
Front non densément pubescent, surface bien visible; apex de chaque élytre aigu ou étroitement arrondi; Dakota du Sud, Michigan ....
.... *quadriguttatus* **Gory** (p. 260)
6. Forme de l'Est, s'étend vers l'ouest jusqu'à l'Idaho (?) et le Montana; élytres foncés, avec des taches formées d'une pubescence blanche ou dorée ....
.... *granulatus granulatus* **(Say)** (p. 261)
Forme de l'Ouest, répartie de la Colombie-Britannique jusqu'au sud-ouest de l'Alberta et le Montana; élytres cuivrés à verdâtres ou bleuâtres, souvent avec des taches pubescentes blanchâtres .... *granulatus populi* **Fisher** (p. 261)

Agrilus anxius Gory

Figs. 229, 258; Map 66

Agrilus anxius Gory, 1841:226; Knull 1925:45; Chamberlin 1926:49; Fisher 1928:160; Craighead 1950:191; Barter and Brown 1949:246; Anderson 1966:248; Barr 1971:87; Baker 1972:161; Wellso et al. 1976:16.
Agrilus torpidus LeConte, 1860:247.
Agrilus gravis LeConte, 1860:247.

Description. Head bronzy green in front (♂), more coppery in female; pronotum and elytra greenish black to bluish gray, sometimes with distinct coppery tinge, especially on pronotum; ventrally more greenish. Head rather narrow, nearly flat; surface coarsely, densely punctate, becoming longitudinally rugose on vertex, sparsely clothed with long, recumbent, whitish pubescence on lower half; epistoma slightly transverse between antennae, broadly but not deeply emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.5 times wider than long, widest at middle; sides strongly arcuately rounded from apical angles to base; disc moderately convex, with a more or less distinct median depression composed of two parts, with round, shallow impression on each side, with broad, moderately deep lateral impressions, and with sharply defined, arcuate, prehumeral carinae; surface weakly granulose, densely but not deeply transversely rugose, finely, sparsely punctate between rugae. Elytra about equal in width at base and at middle; sides parallel for a short distance behind middle, obliquely narrowed to acutely rounded, strongly serrulate elytral apices; disc slightly flattened, costae weakly indicated, with broad, deep, basal impressions; surface densely, finely, imbricate-punctate. Ventral surface finely punctate, more densely punctured laterally, strongly rugose on basal segments, sparsely clothed with moderately long, semierect, white setae; pygidium coarsely punctate, strongly carinate, carina strongly projecting; first abdominal sternite broadly, longitudinally concave at middle, second with deep, smooth groove (♂) or first and second sternites convex or weakly flattened at middle (♀). Tibiae slender, anterior and middle pairs with very small tooth on inner margin at apex (♂) or tibiae unarmed at apex (♀). Tarsal claws dissimilar, anterior and middle claws cleft near apex, posterior claws cleft near middle, inner teeth not turned inward. Aedeagus as in Fig. 229. Length 5.5–13.0 mm.



Map 66. Collection localities of *Agrilus anxius*.

Distribution. Transcontinental, south through the eastern United States to West Virginia in the east and to Arizona in the west.

Hosts. Evidently host specific on birch (*Betula* spp.).

Comments. Adults of this species are variable in coloration, varying from uniform greenish black to bluish gray to those having the pronotum more coppery red. The median pronotal depressions may be entire or divided into two parts, and in some specimens there is a small, round depression on each side of the middle anteriorly, but these impressions may be entirely absent in some specimens. The elytral costae vary from obliterated to vague.

This species has received considerable attention due to the great amount of injury to birch in southern Canada and northern United States. Its common name is bronze birch borer.

Adults begin to emerge in late May or early June and feed upon the leaves for about 3 weeks before oviposition begins. Eggs are deposited singly or in groups beneath loose flakes of bark and in cracks and crevices on the bark. Upon hatching, the larvae bore directly through the bark to the cambial area. There they excavate galleries between the bark and the wood, with occasional side trips into the xylem, to overwinter. The galleries wind back and forth across the grain of the wood. Mature larvae excavate oblong cells in the xylem or in thick bark to overwinter, and pupate in the spring. Larval of all sizes and ages have been found in infested trees during the winter, but the only ones capable of becoming adults are those that were mature before winter began and were later subjected to below freezing temperatures. Two years are required to complete the life cycle in the north.

The larvae have been described and illustrated by Benoit (1965).

The bronze birch borer prefers weakened or injured trees, such as those left behind following logging operations or those weakened by drought or other factors. Damage can be extremely severe to such trees; recently, enormous volumes of birch were killed in the northeastern United States and Canada (Baker 1972). In 1939, nearly 1 million cords were killed in Canada alone (Brown 1940).

Agrilus pensus Horn

Map 67

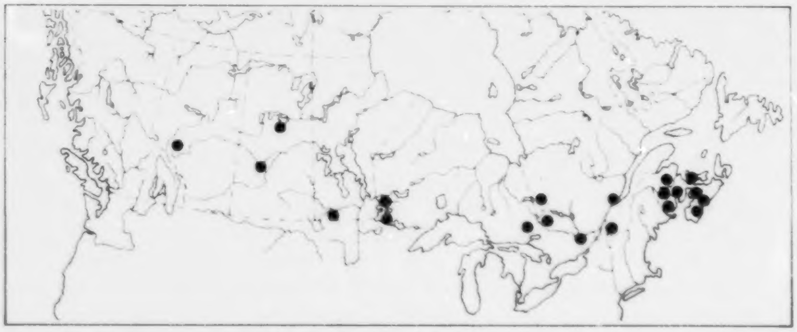
Agrilus pensus Horn, 1891:305; Knull 1925:45; Chamberlin 1926:76; Fisher 1928:155; Barter and Brown 1949:246; Carlson and Knight 1969:105; Wellso et al. 1976:16.

Agrilus betulae Fisher, 1928:153; Craighead 1950:192.

Description. Identical to *anxius*, separable only by the dark coppery red coloration and by the host plants.

Hosts. Reared from alder (*Alnus rugosa*) and birch (*Betula nigra*); collected from foliage of alder (*A. rugosa* and *A. crispa*). Fisher (1928) records hop hornbeam (*Ostrya virginiana*) but this is questionable.

Distribution. Manitoba to Nova Scotia, south to Pennsylvania and New Jersey.



Map 67. Collection localities of *Agrilus pensus*.

Comments. This species is known as the alder-birch borer by Carlson and Knight (1969). The bionomics of this species have been worked out by these two authors and the following acount is condensed from their work.

Eggs are laid on the bark surface of living alder or birch. Incubation of the eggs probably takes about 2 weeks. When embryonic development is complete, the first instar larvae bore out of the egg and into the bark of the host, leaving the egg shell packed with frass.

The larvae boring in *Alnus rugosa* often form galleries without any regular pattern. Sometimes the galleries are sinuate, particularly when they do not lie deeply in the wood. Spiral galleries, such as those made by *anxius* larvae, are not made by *pensus* larvae, even when they bore in alder branches only about 2.5 cm in diameter.

Because the bark of the host plant is so thin and deterioration of the phloem so rapid once death occurs, this species oviposits only on living trees or branches, although it seems likely that the host is under some type of stress. The host dies during the earlier stages of larval development.

The larvae overwinter either as mature larvae in the pupal chambers or as early instars deep in the xylem. Adults begin to emerge in late May or early June. Two years is usually required for a generation cycle.

Agrilus horni Kerremans

Agrilus blanchardi Horn, 1891:305 (preoccupied).

Agrilus horni Kerremans, 1900:341 (replacement name); Chamberlin 1926:65; Fisher 1928:159; Nord, Knight, and Vogt 1965:33–41; Carlson and Knight 1969:105; Baker 1972:162; Wellso et al. 1976:16.

Description. Similar to *anxius*, separable by the characters given in the key.

Hosts. Reared from shoots of poplar and aspen (*Populus* spp.).

Distribution. Manitoba and Quebec, east to Massachusetts, south to Arizona.

Canadian records. Husavick, Man., and Berthier, Que.

Comments. This species is known as the aspen root girdler. The principal host is trembling aspen, but large-toothed aspen and balsam poplar are also infested. Balsam poplar is often severely damaged. This species can be especially troublesome in orchardlike experimental plots of various *Populus* species.

Fisher (1928) had only one specimen that he considered abnormal when he discussed this species. He questioned its validity but retained it as a species until further study. Barter and Brown (1949) listed this species as a questionable synonym of *anxius*. Carlson and Knight (1969) present morphological and biological evidence which shows that *horni* is a distinct species.

Eggs are deposited on the surface of the bark of the host plant and after eclosion, the larvae bore directly into the phloem. A first instar larva excavates a comparatively long gallery ranging in length from 30 cm to 1 m.

The larvae, upon reaching the phloem, tunnel downward until they enter the root. Just before reaching the root they may make one or two, or more, spirals in the phloem before entering the xylem. Various kinds of galleries are made by the larvae, depending on the size or condition of the root. When the root becomes too small for the larvae to continue their boring, they turn back toward the stem. After reentering the stem, they bore in a rather loosely spiralled or almost straight gallery that departs from the cambial region. The stems die about the beginning of pupal maturity. The level at which the pupal chambers are usually located in the stems is 10 or 12 cm aboveground, but this may vary from 5 to 35 cm aboveground.

The life cycle takes about 2 years but may take longer in some instances.

Agrilus liragus Barter & Brown

Fig. 230; Map 68

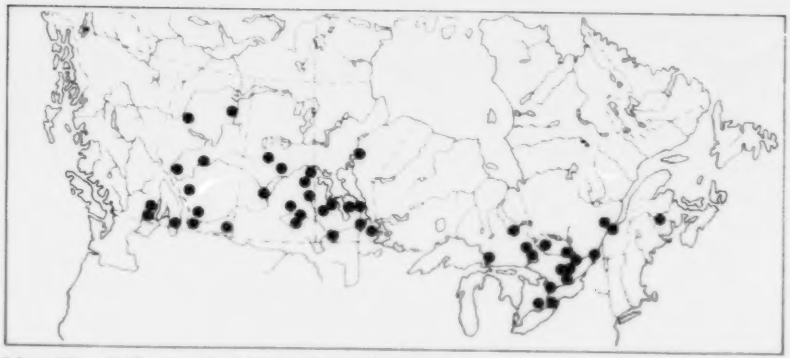
Agrilus liragus Barter and Brown, 1949:247; Anderson 1966:248; Barr 1971:88; Baker 1972:162; Wellso et al. 1976:16.

Agrilus granulatus liragus: Carlson and Knight 1969:6.

Description. Similar to *anxius*, separated with certainty only by the color, characters of the aedeagus (Fig. 230), and by the food-plant.

Hosts. Reared from poplar and aspen (*Populus* spp.).

Distribution. New Brunswick to British Columbia, south to Pennsylvania and Arizona.



Map 68. Collection localities of *Agrilus liragus*.

Comments. Carlson and Knight (1969) discuss this species extensively as a subspecies of *granulatus*. I have chosen to regard it as a full species, because this seems to reflect the distributional pattern more closely.

Barter and Brown (1949) state that *anxius* and *liragus* are separable only by color, by characters on the aedeagus, and by the food-plant. Carlson and Knight (1969) have shown that the two species are separable by a number of morphological characters. For example, the unguifer (the membraneous attachment of the tarsal claws) of *liragus* appears to be more flexible or looser than that of *anxius*. As a consequence, the tarsal claws of *liragus* are often well separated from the unguifer, making the latter clearly visible. The unguifer of *anxius* is more difficult to see because the claws are attached in such a way that there is very little space between their bases and the unguifer. In addition, the claws of *anxius* are usually distinctly swollen at their bases and tend to obscure their attaching membrane, which stretches across the opening in the last tarsomere, whereas in *liragus* the basal parts of the claws are not strongly swollen, and the membrane in the tarsomere opening is more readily visible.

The females of *anxius* and *liragus* differ in the shape of the projecting spine on the pygidium, but the males do not. In *liragus* females the spine usually projects strongly and is rather cylindrical, whereas in *anxius* females the spine is shorter and blunt.

An additional characteristic is the tendency for the elytral tips of female *liragus* to be acute and strongly serrate, whereas those of *anxius* are more broadly rounded and not as strongly toothed. By using the coloration differences, and the obscure and variable structural features of the elytra, pygidium, and tarsal claws it is usually possible to distinguish the females of *liragus* and *anxius*.

The best characters for distinguishing males are those of the aedeagus (Fig. 230).

This species is known as the bronze poplar borer. As with other species in this group, the eggs are laid on the bark surface under scales or in bark irregularities of trees that are dying or severely injured, or that have been blown down. After hatching, the larvae move directly through the bark to the cambial region. This species mines chiefly in the phloem, constructing meandering or sinuate galleries. Host conditions evidently determine the type of gallery. In older, weakened, or decadent trees the mines meander in no particular direction, suggesting that the larvae search out and feed on the freshest phloem available. In more vigorous hosts, the galleries are more sinuate and regular. Pupation takes place in cells constructed in the xylem or in the thick bark. Adults emerge in the spring, feed for a short while on *Populus* leaves, then begin mating and oviposition. Two years are usually required for a life cycle (Barter 1965; Baker 1972).

Agrilus quadriguttatus Gory

Agrilus quadriguttatus Gory, 1841:228; Fisher 1928:141; Craighead 1950:192; Carlson and Knight 1969:6.

Description. Similar to *granulatus*, separable by the characters given in the key.

Hosts. Willow (*Salix* spp.).

Distribution. Eastern United States, north to Michigan and South Dakota, south to Texas. May possibly occur in southern Ontario or the southern portions of the Prairie Provinces.

Comments. This species is included herein based on Michigan and South Dakota records furnished by Dr. G. H. Nelson (pers. comm. 1983).

Adults are similar to those of *granulatus*. In addition to the characters mentioned in the key, *quadriguttatus* may be distinguished by the more convex head, by the more regularly rounded (not strongly sinuate near the base) lateral pronotal margins, by the more obscure median impression, by the scarcely pubescent lateral impressions and deeper transverse rugae on the pronotal surface, and by the less distinct elytral spots.

Three subspecies were designated by Carlson and Knight (1969); only the nominate subspecies would occur in Canada.

Agrilus granulatus granulatus (Say)

Buprestis granulata Say, 1823:162.

Agrilus granulatus: Knull 1925:44; Chamberlin 1926:64; Fisher 1928:138; Wellso et al. 1976:16.

Agrilus granulatus granulatus: Carlson and Knight 1969:1-105.

Description. Front of head densely pubescent; elytra dark, often with golden pubescent spots; otherwise similar to *anxius*, separable with certainty by characters of the aedeagus (as in Fig. 231).

Hosts. Reared from poplar (*Populus* spp.).

Distribution. Occurs from Great Plains eastward but limits are not well-known. Known from New York to Montana, south to Oklahoma and Mississippi.

Comments. This species (and subspecies) are not well-known. According to Fisher (1928) most records of this species refer to *quadriguttatus* Gory. Carlson and Knight (1969) refer to this species only briefly in their discussions.

There is a question in my mind that perhaps *liragus* is actually Say's *granulatus*, but this problem has not yet been addressed.

The habits are essentially as in *anxius*.

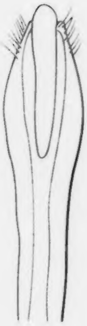
Agrilus granulatus populi Fisher

Fig. 231

Agrilus populi Fisher, 1928:150; Barr 1971:87.

Agrilus granulatus populi: Carlson and Knight 1969:6.

Agrilus trichocarpae Chamberlin, 1926:112.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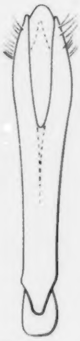
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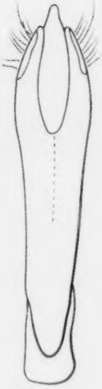
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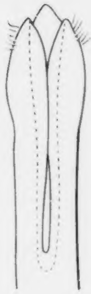
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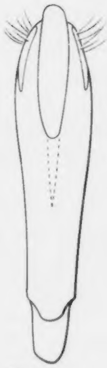
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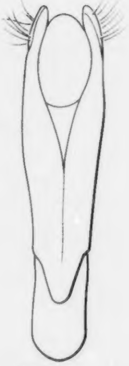
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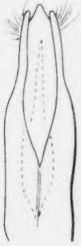
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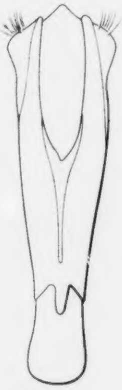
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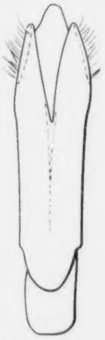
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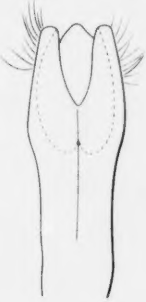
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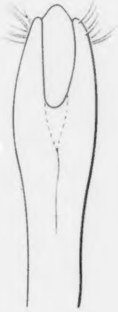
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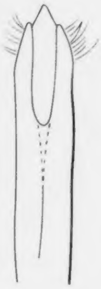
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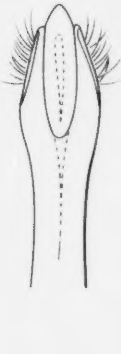
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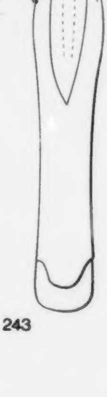
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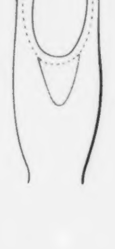
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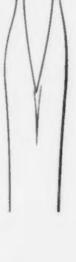
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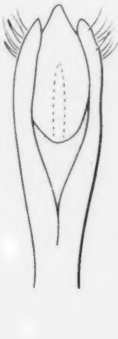
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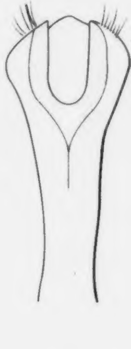
247

Description. Elytra coppery to greenish or bluish, with whitish pubescent spots; otherwise as in *granulatus granulatus*. Aedeagus as in Fig. 231.

Hosts. Reared from poplar (*Populus* spp.).

Distribution. British Columbia to southwestern Alberta, east to western Montana, south to California.

Comments. This is the western form of *granulatus*, which overlaps and hybridizes with the eastern subspecies in a narrow zone on the eastern edge of the Rocky Mountains.

Adults differ only by the elytral coloration mentioned in the key, but this coloration is so obscure and variable that distinction is more easily made on locality data.

The habits are similar to those of *anxius*. This species is reported to cause considerable damage to hybrid poplar shelterbelts in southern Alberta, where trees are susceptible to attack by drought and winter drying. Damage is also common on native and planted poplars in the grassland and southern parkland of Alberta (Brown and Stevenson 1964, 1965).

Agrilus bilineatus bilineatus (Weber)

Figs. 59, 61, 66, 232, 257; Map 69

Buprestis bilineata Weber, 1801:74.

Agrilus bilineatus: Knull 1925:44; Chamberlin 1926:54; Craighead 1950:190; Fisher 1928:113; Anderson 1966:248; Baker 1972:160; Wellso et al. 1976:15.

Agrilus flavolineatus Mannerheim, 1837:110.

Agrilus bivittatus Kirby, 1837:161.

Agrilus aurolineatus Gory, 1841:248.

Description. Head bronzy green (♂) or brownish black with distinct coppery or brassy tinge; pronotum black, opaque, sometimes with weak greenish or brassy coppery tinge; elytra black, opaque, with a distinct greenish or bluish tinge; ventrally dark bronzy green, sometimes with weak coppery reflection. Head weakly to moderately convex, with weak, narrow, longitudinal groove extending from vertex to middle of frons; surface coarsely, densely punctate or scabrous in front, becoming longitudinally rugose on occiput, sparsely clothed with short, semierect setae; epistoma narrow between antennae,

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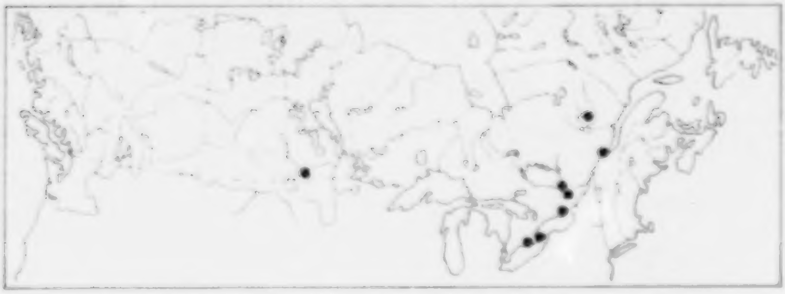
Figs. 230–247. Aedeagi of *Agrilus* spp. (231–242, 245–247 redrawn from Fisher 1928; 230 redrawn from Barter and Brown 1949; 243 redrawn from Knull 1944). 230, *A. liragus*; 231, *A. granulatus populi*; 232, *A. bilineatus bilineatus*; 233, *A. criddlei*; 234, *A. acutipennis*; 235, *A. walsinghami*; 236, *A. obsoletoguttatus*; 237, *A. fallax*; 238, *A. aurichalceus*; 239, *A. politus*; 240, *A. cyanescens*; 241, *A. cephalicus*; 242, *A. crataegi*; 243, *A. amelanchieri*; 244, *A. subcinctus*; 245, *A. lecontei*; 246, *A. pseudofallax*; 247, *A. egeniformis*.



Map 69. Collection localities of *Agrilus bilineatus bilineatus*.

broadly, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.5 times wider than long, widest along apical fourth; sides nearly parallel or weakly arcuate from apical angles to middle, obliquely narrowed to posterior angles; disc moderately convex, with 2 round, weak, median impressions, one near anterior margin, the other near base, with rather deep impression on each side along lateral margin, and without prehumeral carinae; surface densely, transversely rugose medianly, becoming finely, densely punctate toward sides, which are densely clothed with long, recumbent, golden yellow or whitish pubescence. Elytra slightly wider at base than at apical third; sides nearly parallel behind base, deeply, broadly constricted in front of middle, and arcuately attenuate from apical third to broadly rounded, strongly serrulate apices; disc strongly flattened, without longitudinal costae, with broad, deep, basal impressions; surface densely, coarsely, imbricate-punctate, and with narrow stripe of dense yellowish or whitish pubescence extending from basal impression to apex (sometimes stripe only distinct in basal impressions). Ventral surface finely, sparsely punctate along midline, more densely and coarsely punctate laterally, sparsely clothed with short, recumbent, cinerous setae; pygidium coarsely punctate, strongly carinate, carina projecting and truncate at apex; first abdominal sternite slightly flattened at middle, second abdominal sternite with deep, smooth groove at middle (♂) or convex and not grooved at middle (♀). Tibiae slender, nearly straight, protibiae and mesotibiae with small tooth on inner margin near apex, metatibiae unarmed (♂) or all tibiae unarmed at apex (♀). Tarsal claws dissimilar, these on anterior and middle tarsi, cleft near middle, inner tooth slightly shorter and weakly turned inward, tips widely separated (♂) or tarsal claws similar on all tarsi, cleft near middle, inner tooth slightly shorter and weakly turned inward, tips widely separated (♀). Aedeagus as in Fig. 222. Length 4.2–9.5 mm.

Hosts. Known from oak (*Quercus* spp.) and chestnut (*Castanea dentata*).

Distribution. Manitoba to Quebec, south through the eastern United States to Florida and Texas.

Comments. This species shows considerable variation in size due to environmental conditions. Maculation is also variable with the pubescence on the pronotum and with the color on the elytra stripes, which varies from golden yellow to white, with all intermediate shades. Usually the elytral stripes extend from the basal impressions to the tips, but frequently specimens are seen in which the stripes are only indicated near the basal impressions.

The biology of this species has recently been studied in detail by Dunbar and Stephens (1976), Cote and Allen (1980), and Haack and Benjamin (1982).

This species is commonly known as the twolined chestnut borer. It does considerable damage to oak and chestnut trees in southern Canada and the eastern United States. Winter is spent in the prepupal stage in cells constructed in the outer layers of the sapwood and sometimes in the bark. In the spring, adults emerge through characteristic D-shaped holes in the bark. A short period of maturation feeding takes place before mating and egg-laying. Eggs are laid on the bark of the main trunk and larger limbs in the late spring, and after eclosion the young larvae bore through the bark to the phloem layer. There they construct winding mines in the inner bark and outer wood. These mines meander in all directions, and in the event of a heavy attack, may girdle the trunk and thereby kill the tree. Attacks usually begin in treetops and extend downward as the tree continues to weaken. Two years are required to complete a life cycle in the north.

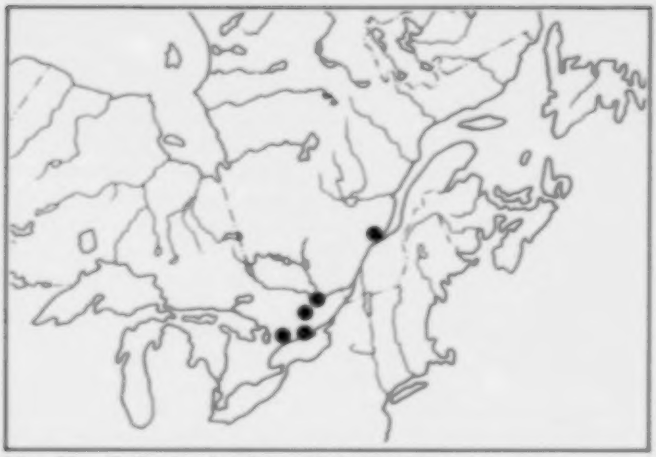
The economic importance of this species is somewhat questionable. There is no doubt that it attacks living trees, but frequently the host tree is able to withstand the attack and eventually heals over the galleries or may even repel the attack, and kill all the larvae. However, successful attacks can hasten the death of the host tree, which almost always has been weakened by some external stress such as root disease, drought, defoliation, fire, wind, or severe frosting. Studies have led to the conclusion that this species attacks only trees that are severely weakened and that it does nothing more than hasten the death of such trees. Nevertheless, following severe oak defoliation such as that recently experienced in Connecticut, this species has shown the capabilities of rapidly increasing in number and bringing about large-scale oak mortality.

Agrilus bilineatus carpini Knull

Map 70

Agrilus bilineatus var. *carpini* Knull, 1923:105; Knull 1925:44; Chamberlin 1926:55; Fisher 1928:119; Wellso et al. 1976:15.

Description. Similar to *bilineatus bilineatus*. Head bronzy green, becoming brownish black on occiput; pronotum brownish black at middle, becoming bronzy green laterally; surface sparsely clothed with short, recumbent, yellow setae; elytra bright blue or bluish black, with spot of short, recumbent, golden setae in basal impressions and vague stripe of shorter whitish setae along sutural margin at apical fifth; ventrally greenish. Length 8.0 mm.



Map 70. Collection localities of *Agrilus bilineatus carpini*.

Hosts. Known from American hornbeam (*Carpinus caroliniana*), beech (*Fagus* spp.), and eastern hop hornbeam (*Ostrya virginiana*).

Distribution. Ontario, Quebec, south to Illinois, Connecticut, Vermont, and Pennsylvania.

Comments. Whether this form should be considered a species, a subspecies, or simply a variety of *bilineatus* is open to question. I have treated it as a subspecies here following the usage of Fisher (1928), Wellso et al. (1976), and Hespenhide (1979).

The color of the elytra varies from bright blue to bluish black. The pubescence is always visible in the basal impressions and sometimes along the sutural margins near the apex.

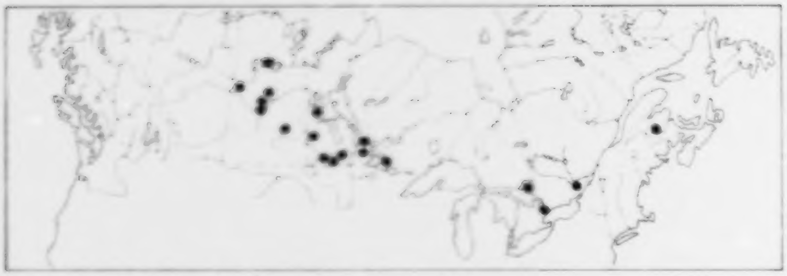
The life cycle is probably similar to that given for *bilineatus bilineatus*.

Agrilus criddlei Frost

Fig. 233; Map 71

Agrilus criddlei Frost, 1920:249; Chamberlin 1926:57; Fisher 1928:122; Wellso et al. 1976:15.

Description. Body bronzy black, with slight bluish and coppery reflection; ventrally slightly more bronzy. Head nearly flat, without distinct impressions, with narrow, longitudinal groove extending from occiput to middle of frons; surface coarsely, densely punctate, punctures more or less confluent, sparsely clothed with short, inconspicuous, semirecumbent, white setae; epistoma wide between antennae, broadly, deeply, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.5 times



Map 71. Collection localities of *Agrilus criddlei*.

wider than long, widest at middle; sides slightly, arcuately rounded; disc moderately convex, with broad, deep impression in front of scutellum, vague impression in front of scutellum, vague impression on each side in front of middle, small, deeper impression laterally along base near posterior angles, broad, shallow impression on each side along lateral margins, and more or less distinct swelling near posterior angles in place of prehumeral carina; surface densely, transversely rugose, finely punctate between rugae, sparsely clothed with short, inconspicuous setae. Elytra equal in width at base and apical third; sides nearly parallel behind base, broadly, weakly, arcuately constricted before middle, broadly, arcuately expanded at apical third, then obliquely attenuate to narrowly rounded, strongly serrulate apices; disc weakly flattened, without longitudinal costae, with broad, shallow, basal impressions; surface densely, coarsely, imbricate-punctate, uniformly clothed with short, recumbent, whitish setae. Ventral surface finely, sparsely punctate along middle, more densely laterally, sparsely clothed with short, recumbent, whitish setae; pygidium strongly carinate, carina projecting and truncate at apex; first abdominal sternite broadly concave at middle, second with broad, deep, smooth groove (♂) or first abdominal sternite weakly flattened, second not grooved at middle (♀). Tibiae slender, straight, protibiae and mesotibiae with small tooth on inner margin at apex, metatibiae without tooth (♂) or all tibiae unarmed at apex (♀). Tarsal claws similar on all tarsi, cleft near middle, inner tooth slender, equal in length, not turned inward. Aedeagus as in Fig. 233. Length 7.5 mm.

Hosts. Reared from willow (*Salix* spp.).

Distribution. Saskatchewan to New Brunswick, south to Michigan.

Comments. This little known species may be confused with *anxius* but can be distinguished by the lack of distinct prehumeral carinae on the pronotum (sometimes with an obtuse swelling near posterior angles), by the tarsal claws all being similarly cleft in the males, and by the lateral lobes of the aedeagus being only weakly expanded near the tips, with the median lobe acute at the apex (Fig. 233).

Little variation was noted in the limited material examined.

Nothing is known of the life history or biology of this species.

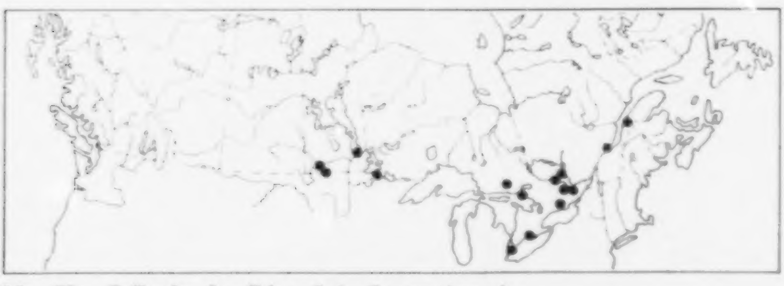
Agrilus acutipennis Mannerheim

Fig. 234; Map 72

Agrilus acutipennis Mannerheim, 1837:109; Knull 1925:46; Chamberlin 1926:47; Fisher 1928:127; Baker 1972:163; Wellso et al. 1976:15.

Agrilus latebrus Laporte and Gory, 1841:38.

Description. Body above dark blue with more or less distinct blackish or greenish tinge; ventrally varying from dark blue to blackish green, sometimes with distinct brassy tinge. Head wide, flat, deeply impressed or concave on vertex and occiput, with narrow, longitudinal groove extending from occiput to middle of frons; surface coarsely, densely punctate on front, becoming rugose on vertex, sparsely clothed with short, whitish setae; epistoma narrow between antennae, broadly, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.5 times wider than long, widest at middle; sides regularly, arcuately rounded; disc moderately convex, with median depression divided at middle, anterior part obsolete, posterior half distinct, deeply, broadly impressed, sometimes with small impression on each side toward anterior margin, with small impression on each side along base near posterior angles, and broad, deep depression along lateral margins, and without distinct prehumeral carina; surface coarsely, densely, transversely rugose, densely punctate between rugae and without distinct pubescence. Elytra about equal in width at base and apical third; sides parallel for short distance behind base, broadly arcuately constricted in front of middle, arcuately expanded at apical third, then obliquely attenuate to broadly rounded, strongly serrulate apices; disc strongly flattened, without longitudinal carinae, with broad, deep, basal impressions; surface coarsely, densely imbricate-punctate, without distinct pubescence. Ventral surface densely, finely punctate, densely, transversely rugose laterally, sparsely clothed with short, recumbent, whitish setae; pygidium coarsely punctate, strongly



Map 72. Collection localities of *Agrilus acutipennis*.

carinate, carina projecting, truncate at apex; first abdominal sternite broadly flattened at middle, second with deep, smooth groove extending to behind middle (♂) or both sternites convex, not grooved at middle (♀). Tibiae slender, nearly straight, protibiae and mesotibiae with small tooth on inner margin at apex, metatibiae unarmed (both sexes). Tarsal claws dissimilar, those on anterior and middle tarsi cleft near tip, teeth nearly equal in length, those on posterior tarsi more deeply cleft, teeth weakly turned inward (♂) or tarsal claws similar on all tarsi, cleft near middle, teeth about equal in length, inner tooth slightly turned inward, tips distant (♀). Aedeagus as in Fig. 234. Length 7.5–10.0 mm.

Hosts. Larval host unknown. Adults have been collected on oak (*Quercus* spp.), birch (*Betula* spp.), poplar (*Populus* spp.), and American hazel (*Corylus americana*).

Distribution. Manitoba to Quebec, south through the eastern United States to Florida and Texas.

Comments. The color of this species varies from brilliant blue to black; otherwise little variation is encountered.

Tree damage by this species results in a fungus infection known as grease spot, which spreads through the wood from the larval tunnels. The infected areas are diamond- or spindle-shaped in cross section and are about 18 mm wide. The presence of this species in wood greatly reduces the value of the lumber. Infestations are mostly found in river bottoms where the host trees are periodically flooded during winter and spring. Entire stands in such situations may be infected.

Females deposit eggs on the bark surface. The larvae bore through the bark and excavate patches of inner bark up to 10 mm, or more, in diameter. Later, they enter the wood and tunnel spirally upward in the outermost growth ring. Pupation occurs in the tunnel and the life cycle requires 2 years.

Agrilus nigricans Gory

Agrilus nigricans Gory, 1841:257; Fisher 1928:199 (as synonym of *obsoletoguttatus*); Nelson 1980:85.

Agrilus auricomus Frost, 1912:250; Knull 1925:46; Chamberlin 1926:53; Fisher 1928:130.

Description. Head green to bronzy brown in male, more coppery in female; pronotum brassy, with distinct coppery tinge; elytra black or brown, with vague greenish reflection; ventrally greenish or brassy, with weak coppery tinge. Head nearly flat, with narrow, longitudinal groove extending from vertex nearly to epistoma, more deeply impressed on occiput and vertex; surface densely, coarsely punctate, more or less rugose on vertex; epistoma narrow between antennae, broadly, shallowly emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.5 times wider than long, widest at middle; sides regularly, arcuately rounded; disc moderately convex, with broad, shallow, median impression vaguely divided at middle, small impression on each side along base near posterior angles, with broad, deep impression on each side along lateral margins, and without distinct prehumeral carinae; surface deeply, coarsely, transversely rugose, finely punctate between rugae, sparsely clothed with recumbent, yellowish setae in the lateral impressions. Elytra distinctly wider at base than at apical third; sides nearly parallel behind base, strongly, broadly, arcuately constricted before middle, weakly expanded at apical third, obliquely attenuate to narrowly rounded, strongly serrulate apices; disc flattened, obscurely costate laterally, and with deep, broad, basal impressions; surface densely, coarsely, imbricate-punctate, without distinct pubescence, except for narrow, obsolete stripe of short, sparse, yellowish setae along middle. Ventral surface finely, sparsely punctate along middle, more rugose laterally, sparsely clothed with short, recumbent, yellowish setae; pygidium strongly carinate, carina projecting and truncate at apex; first abdominal sternite distinctly flattened at middle, second with wide, deep groove (♂) or first and second sternites convex, without median groove (♀). Tibiae slender, straight, protibiae and mesotibiae with short tooth on inner margin at apex (♂) or all tibiae unarmed at apex (♀). Tarsal claws dissimilar, those on anterior tarsi cleft near tip, the teeth nearly equal in length, those on middle and posterior tarsi cleft near middle, inner tooth shorter, slightly turned inward (♂) or tarsal claws all similar, cleft near middle, inner tooth shorter, slightly turned inward, tips widely separated (♀). Length 7.7–12.0 mm.

Hosts. Unknown. Adults collected on red oak (*Quercus rubra*).

Distribution. Ontario, south to Pennsylvania and Massachusetts.

Canadian record. Fishers Glen, Ont.

Comments. In most studies of North American *Agrilus, nigricans* is listed as a synonym of *obsoletoguttatus* Gory. Nelson (1980) states that the two are not the same species and that *nigricans* is the same as, and must replace, *auricomus*.

This species displays considerable variation in color and structural features. The elytra vary from greenish black to greenish brown and the front of the head in males from green to bronzy brown. The median impression of the pronotum is somewhat variable in depth, sometimes there is a small, round impression on each side of the middle and sometimes there are vague prehumeral carinae. The ventral color varies from green to bronzy coppery, and the pubescence varies from yellowish white to golden yellow.

Nothing is recorded on the life history or biology.

Agrilus quadriimpressus Ziegler

Agrilus quadriimpressus Ziegler, 1845:267; Fisher 1928:133; Wellso et al. 1876:16.

Agrilus acutipennis Horn, 1891:307 (in part).

Description. Head green or brassy (♂), green to coppery (♀); pronotum and elytra varying from greenish to black, with more or less distinct brassy, greenish or bluish tinge; ventrally, the same but more shining. Head flat, more or less deeply impressed on vertex and occiput, with narrow, longitudinal groove extending from the vertex to middle of frons; surface densely, coarsely punctate, somewhat rugose; epistoma rather narrow between antennae, broadly, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.5 times wider than long, widest near middle or apical third; sides rather strongly, arcuately rounded; disc convex, with broad, moderately deep impression in front of scutellum, sometimes with 2 small impressions on anterior part of disc, with small impression laterally along base near posterior angles and broad, deep impression along lateral margins, and without prehumeral carinae; surface coarsely, densely, transversely rugose, finely punctate between rugae and toward lateral margins, without distinct pubescence. Elytra about equal in width at base and apical third; sides nearly parallel for short distance behind base, broadly, arcuately constricted in front of middle, arcuately rounded on apical third, obliquely attenuate to broadly rounded, strongly serrate apices; disc strongly flattened, with obsolete longitudinal costae at middle of each elytron; surface densely, finely, imbricate-punctate, without distinct pubescence except for several white setae at apex and a narrow obsolete row of short, whitish setae along sutural margin at apical fourth. Ventral surface finely, sparsely punctate along middle, more densely laterally, sparsely clothed with short, recumbent, whitish setae; pygidium coarsely punctate, strongly carinate, carina strongly projecting and truncate at apex; first abdominal sternite slightly flattened at middle, second with deep, smooth groove (♂) or second sternite not grooved (♀). Tibiae slender, straight, protibiae and mesotibiae each with distinct tooth on inner margin at apex (♂), tooth less distinct in female. Tarsal claws dissimilar, those on protarsi cleft near tips, teeth nearly equal in length, those on mesotarsi and metatarsi cleft near middle, inner tooth shorter than outer tooth, slightly turned inward, tips distant (♀) or tarsal claws alike on all tarsi, similar to those on metatarsi of male. Length 7.5–10.5 mm.

Hosts. Recorded from oak (*Quercus* spp.).

Distribution. Eastern United States from Michigan to Massachusetts, south to Texas. Not recorded from Canada but probably occurs in southern Ontario at least.

Comments. Adults of this species vary only slightly. The color and impressions on the pronotum are variable and the elytral tips in some specimens may be subacute.

This species is similar to *acutipennis* but in *acutipennis* the elytra are usually blue, with only an occasional black specimen and the vertical portions of the second abdominal sternite are entirely glabrous, whereas in *quadriimpressus* the elytra are more greenish black and the vertical portions of the second abdominal sternite are pubescent.

Nothing is known of the life history or biology of this species.

Agrilus walsinghami Crotch

Fig. 235

Agrilus walsinghami Crotch, 1873:95; Chamberlin 1926:86; Fisher 1928:176; Barr 1971:88.

Description. Head and pronotum bronzy green, with feeble coppery reflection (♂); elytra brassy, slightly purplish and more coppery near base (♂) or uniformly bluish green above (♀); ventrally brownish black, bronzy green on abdomen, legs more or less coppery. Head rather wide, with deep, triangular depression having its base above epistoma, and with narrow, longitudinal groove extending from depression to vertex; surface coarsely, densely punctured, punctures somewhat confluent; epistoma not transverse between antennae, strongly elevated, broadly, deeply, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum 0.3 times wider than long, widest at middle; sides weakly, arcuately rounded from base to apex; disc strongly convex, with broad, vague, median impression extending from base to apex, with broad, shallow impression on each side along lateral margin at middle and with a broadly rounded elevation replacing prehumeral carina; surface coarsely, densely punctate, punctures widely separated on each side of median impression, sparsely clothed with whitish setae. Elytra distinctly wider at base than just behind middle; sides slightly expanded for short distance behind base, weakly narrowed to behind middle, obsoletely, arcuately expanded, then arcuately narrowed to narrowly rounded, weakly serrate apices; disc weakly flattened, with broad, deep, basal impressions; each elytron with 3 fine, irregular, vague costae extending from base to near apex; surface densely, finely imbricate-punctate, each elytron ornamented by white pubescent spots as follows: one in basal depression, one in front of middle between discal costae, one at middle between costa and lateral margin, and one at apical fourth near sutural margin. Ventral surface coarsely punctate, punctures sparse on median area; pygidium coarsely punctate, strongly carinate, carina not projecting; first abdominal sternite without median depression. Tibiae slender, all armed with distinct tooth on inner margin at apex, shorter in female. Tarsal claws all similar, cleft near middle, more weakly so in female, inner tooth broad, shorter than outer tooth and not turned inward. Aedeagus as in Fig. 235. Length 9.0–13.0 mm.

Hosts. Known only from stinking rabbitbrush (*Chrysothamnus nauseosus*).

Distribution. British Columbia, through the western United States to Arizona and New Mexico.

Canadian records. Cawston, Oliver, and Osoyoos, B.C.

Comments. This species displays a very marked sexual color variation. The female is a uniform bluish green dorsally, whereas the male is more darkly colored with a coppery reflection on the head, pronotum, and elytral bases. The depth of the pronotal impressions vary from nearly obsolete to moderately deep; otherwise adults show only minor variations.

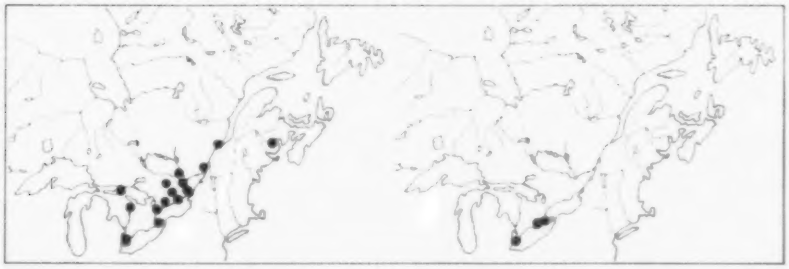
Nothing is known about the life cycle of this species.

Agrilus obsoletoguttatus Gory

Fig. 236; Map 73

Agrilus obsoletoguttatus Gory, 1841:256; Knull 1925:49; Chamberlin 1926:72; Fisher 1928:199; Wellso et al. 1976:16.
Agrilus interruptus LeConte, 1860:246.

Description. Head bronzy green to golden green, becoming coppery brown on occiput (♂) or brassy or coppery (♀); pronotum and elytra bronzy black to greenish brown, sometimes with weak purplish tinge; ventrally bronzy or coppery. Head somewhat narrow, transversely impressed above epistoma and with weak, narrow, longitudinal groove extending from vertex to middle of frons; surface finely, densely granulose, densely, coarsely punctate, somewhat rugose; epistoma strongly transverse between antennae, deeply, broadly emarginate in front. Antennae serrate from the fourth segment. Pronotum about 0.25 times wider than long, widest on apical half or near apex; sides weakly arcuate or narrowed from apex to behind middle, more strongly narrowed to posterior angles; disc moderately convex, with 2, or more, distinct median impressions (one or both may be obsolete), with broad, moderately deep, oblique depression on each side along lateral margin and with sharply elevated prehumeral carinae; surface coarsely, deeply, transversely rugose at middle, finely densely punctate between rugae. Elytra wider at base than behind middle; sides nearly parallel and sinuate behind base, broadly, arcuately constricted in front of middle, broadly expanded behind middle, obliquely narrowed to broadly rounded, strongly serrate apices; disc flattened, sometimes with vague costae on each side; surface densely, coarsely, imbricate-punctate, each elytron with 3 or 4 whitish or yellowish spots as follows: one in basal impression, one an elongate fascia extending from basal fourth to middle, one a round spot at apical third, and sometimes with a small spot exterior to posterior end of middle fascia. Ventral surface finely, densely punctate, punctures somewhat confluent; pygidium coarsely punctate, feebly carinate but carina not projecting; first abdominal sternite flattened, not grooved. Tibiae slender, protibiae and mesotibiae with distinct



Maps 73, 74. 73, Collection localities of *Agrilus obsoletoguttatus*; 74, *A. fallax*.

tooth on inner margin at apex. Tarsal claws all similar, cleft near middle, inner tooth broad, equal to or shorter than outer tooth, not turned inward. Aedeagus as in Fig. 236. Length 4.7–8.0 mm.

Hosts. Reared from American beech (*Fagus grandifolia*), American hornbeam (*Carpinus caroliniana*), eastern hop hornbeam (*Ostrya virginiana*), red oak (*Quercus rubra*), hickory (*Hicoria* spp.), and birch (*Betula* spp.).

Distribution. Ontario to New Brunswick, south through the eastern United States to North Carolina, Mississippi, and Texas.

Comments. Fisher (1928) reports that this species occurs in two forms that cannot be separated except by color. The northern form is usually bronzy black or greenish brown and the pubescent spots on the elytra are usually vague. The southern form, which does not occur in our area, is darker brown and the pubescent spots are more distinct.

Only minor morphological variation was noted. The median impressions on the pronotal disc may be distinct or obsolete. The pronotal shape also varies slightly.

Nothing is recorded on the life history or biology.

Agrilus fallax Say

Fig. 237; Map 74

Agrilus fallax Say, 1839:163; Knull 1925:49; Chamberlin 1926:61; Fisher 1928:193; Wellso et al. 1976:16.

Agrilus zemes Gory, 1841:234.

Agrilus impressipennis Uhler, 1855:416.

Description. Head bright green in front, becoming coppery on occiput (♂) or dark green; epistoma coppery with reddish tinge (♀); pronotum and elytra dark green with coppery tinge, each elytron with 3 more or less distinct pubescent spots; ventrally coppery, median area and legs bronzy or greenish. Head flat, wide, with large distinct foveae behind antennal cavities and with shallow, longitudinal groove extending from epistoma to vertex; surface coarsely, densely granulose, feebly, sparsely rugose (♂) or not distinctly granulose (♀); epistoma strongly transverse between antennae, very broadly, deeply, arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.3 times wider than long, widest near apex; sides nearly parallel at base, obliquely expanded near apex, weakly narrowed to apical angles; disc moderately convex, with broad, median impression in front of scutellum, with broad, deep, oblique impression on each side along lateral margins, and with distinct prehumeral carinae; surface coarsely, deeply, transversely rugose at middle, rugae more or less longitudinal laterally, finely punctate between rugae. Elytra about equal in width at base and behind middle; sides nearly parallel or weakly arcuate behind base, broadly constricted in front of middle, broadly expanded behind middle, obliquely narrowed to broadly rounded, strongly serrate apices; disc slightly flattened, with vague costae on each side, basal impressions broad, shallow; surface coarsely, densely, imbricate-punctate, each elytron with 3 more or less distinct spots as follows: one in basal impression, one in front of middle, and one at apical third. Ventral surface sparsely, finely punctate, punctures connected by weak, sinuate lines; pygidium sparsely, coarsely punctate, weakly carinate, carina not projecting; first and second abdominal sternites with broad, median groove (♂) or convex, without longitudinal groove (♀). Tibiae slender, straight, protibiae and mesotibiae each with small tooth on inner margin near apex (♂) or tooth absent (♀). Tarsal claws dissimilar, anterior ones cleft near tip, teeth nearly equal in length, middle and posterior claws cleft near middle, inner tooth broad, much shorter than outer one, not turned inward (♂) or all tarsal claws cleft at middle (♀). Aedeagus as in Fig. 237. Length 4.0–5.0 mm.

Hosts. Reared from dead and dying honey-locust (*Gleditsia triacanthos*) and hackberry (*Celtis occidentalis*).

Distribution. Ontario and Quebec, south through the eastern United States to South Carolina, Mississippi, and Texas.

Comments. Adults of this species closely resemble those of *obsoletoguttatus* and the two may be easily confused. Adults of *fallax* are usually smaller than those of *obsoletoguttatus* and have the prosternal lobe broadly rounded in front rather than emarginate anteriorally as in *obsoletoguttatus*; also the first abdominal sternite is grooved in the male of *fallax* versus convex in both sexes of *obsoletoguttatus*.

Adults of *fallax* vary in color from dark green to reddish coppery. The median impression on the pronotum varies from a rather deep impression posteriorly, to two vague median impressions, or a weakly impressed median groove, and occasionally a specimen is found without distinct impressions. Other structural variations are only minor.

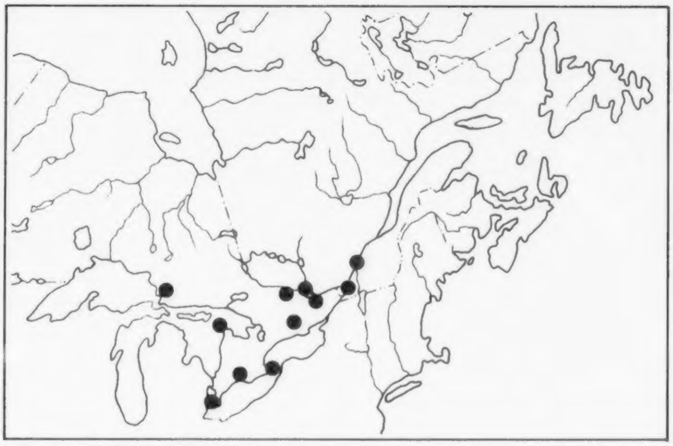
Nothing is recorded on the life history of this species.

Agrilus auricalceus Redtenbacher

Fig. 238; Map 75

Agrilus aurichalceus Redtenbacher, 1849:286; Thery 1969:166.
Agrilus aurichalceus rubicola: Nelson et al. 1981:131.
Agrilus rubicola Abeille, 1897:15; Fisher 1928:209; Wellso et al. 1976:16.
Agrilus viridis var. *fagi* (Ratzeberg) (auct.): Fisher 1928:209.

Description. Head green in front, coppery on occiput (♂) or entirely coppery (♀); pronotum and elytra greenish bronze, with coppery reflections; ventrally greenish bronze, with coppery reflections. Head weakly convex, with weak, longitudinal groove extending from occiput to vertex; surface densely, coarsely punctate, coarsely rugose, rugae confused on frons, longitudinal on vertex; epistoma transverse between antennae, broadly, deeply emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.5 times wider than long, widest near apical fourth; sides obliquely or weakly arcuate from base to apical fourth, then arcuately narrowed to apical angles; disc moderately convex, sometimes with 2 obsolete median impressions, with



Map 75. Collection localities of *Agrilus aurichalceus*.

broad, shallow impression along each side at middle of lateral margin, and with short, arcuate prehumeral carinae; surface densely, transversely rugose, densely, finely punctate between rugae. Elytra about equal at base and just behind middle; sides weakly arcuate behind base, broadly constricted in front of middle, broadly expanded behind middle, obliquely narrowed to broadly rounded, minutely serrate apices; disc weakly flattened, with broad, deep basal impressions; surface densely, finely, imbricate-punctate. Ventral surface finely, densely punctate, punctures connected transversely by fine crenulate lines; pygidium coarsely punctate, not distinctly carinate; first abdominal sternite strongly convex, without median groove. Tibiae slender, protibiae and mesotibiae each with minute tooth on inner margin at apex (♂) or tooth absent (♀). Tarsal claws dissimilar, protarsal and mesotarsal claws weakly cleft near tip, teeth acute at tips, nearly equal in length, posterior claws cleft near middle, inner tooth broad, much shorter than outer one (♂) or claws similar on all tarsi, cleft near middle, inner tooth much shorter and broader than outer one (♀). Aedeagus as in Fig. 238. Length 4.0–6.3 mm.

Hosts. Reared from rose (*Rosa* spp.). Adults collected on current (*Ribes* spp.), and raspberry and blackberry (*Rubus* spp.).

Distribution. Ontario and Quebec, south through the eastern United States, west of Colorado.

Comments. This economically important species is known as the rose stem girdler. It is a European species that was first discovered in the United States in August 1923, after it killed a number of roses in the northern part of New Jersey. At first this species was identified as a variety of *politus*, but Kerremans later identified it as a variety of the European species *viridis* Linnaeus. Obenberger (1927) states that the species identified as *Agrilus viridis* var. *fagi* is *Agrilus communis* ab. *rubricola* Abeille, and that it is distributed throughout the western, eastern, and southern parts of Europe. Fisher (1928) referred to this species as *rubicola* and this name has been used in the literature until the present. However, Thery (1969) placed *rubicola* in synonymy under *aurichalceus*. This action was either overlooked or ignored by subsequent authors until Nelson et al. (1981) used the combination *A. aurichalceus rubicola* Abeille without further explanation. Because this species is introduced and there is no justification for subspecies status, I have used the combination, *A. aurichalceus* Redtenbacher, as used by Thery (1969).

Adults of this species closely resemble those of *politus* and difficulty may be encountered in separating some specimens. The character of the prosternum given in the key should suffice in most instances.

This species passes the winter as larvae inside the pith of the rose cane. The larvae complete their growth in the spring, pupate inside the cane, and emerge as adults in early summer. After a period of feeding and mating, the females lay their eggs in the bark of the cane, usually near the base of a leaf. The young larvae bore into the sapwood, turn upward and continue boring or sometimes make several spiral girdles around the cane, causing the formation of galls, or swellings. There is one generation per year.

politus complex

Agrilus politus is one of the more widespread and variable species in the genus. Fisher (1928) felt that there were several forms which seemed to be biologically different from the typical *politus*. These forms, *pseudocoryli* and *burkei*, were placed as subspecies of *politus*. The host of *pseudocoryli* is hazel (*Corylus* spp.), the host of *burkei* is alder (*Alnus* spp.), and the hosts of *politus* are willow (*Salix* spp.) and maple (*Acer* spp.). The biologies of these forms have not been sufficiently studied to confirm or reject Fisher's treatment and various authors have treated the forms differently. Barr (1971) maintains *burkei* as a full species, as does Furniss and Carolin (1977). I have decided to follow recent authors and give full species status to *burkei* and *politus* and, to be consistent, also to *pseudocoryli*, although my decision regarding the last-named species has been made with considerable hesitation.

Key to species of *politus* complex

1. Inner tooth of anterior and middle claws of male slightly shorter and broader than outer one, and slightly turned inward; front of head of male same color as rest of surface; eastern; on hazel .... ***pseudocoryli* Fisher** (p. 279)
   Inner tooth of anterior and middle claws of male about equal in length and thickness to outer one, not turned inward; front of head of male green 2
2. Color deep blue or bluish green; western; on alder .... ***burkei* Fisher** (p. 280)
   Color green to coppery or leaden; transcontinental; on willow and maple .... ***politus* (Say)** (p. 278)

Tableau des espèces du complexe *politus*

1. Griffes antérieures et médianes chez le mâle avec la dent interne un peu plus courte et plus large que la dent externe, et légèrement recourbée; front chez le mâle de même couleur que le reste de la surface; espèce de l'Est; sur le noisetier .... ***pseudocoryli*** **Fisher** (p. 279)
   Griffes antérieures et médianes chez le mâle avec la dent interne à peu près de même longueur et largeur que la dent externe, non recourbée; front chez le mâle vert 2
2. Bleu foncé ou vert bleuâtre; espèce de l'Ouest; sur l'aulne .... ***burkei*** **Fisher** (p. 280)
   Vert à cuivré ou plombé; transcontinental; sur le saule et l'érable .... ***politus*** **(Say)** (p. 278)

Agrilus politus (Say)

Figs. 45, 239; Map 76

Buprestis politus Say, 1825:251.

Agrilus politus: Knull 1925:47; Chamberlin 1926:77; Fisher 1928:213; Craighead 1950:192; Barr 1971:88; Wellso et al. 1976:16.

Agrilus desertus LeConte, 1860:249 (preoccupied).

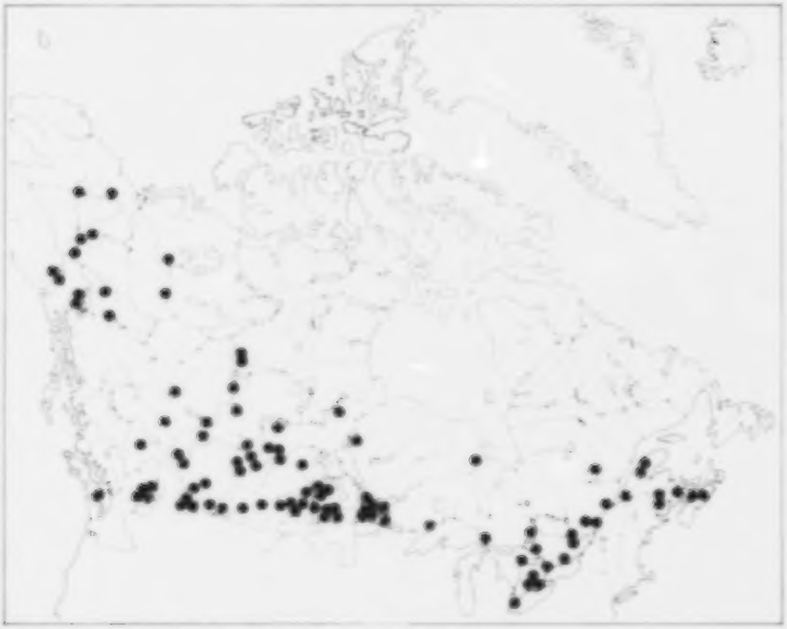
Agrilus cupreolus LeConte, 1860:248.

Agrilus plumbeus LeConte, 1860:247.

Agrilus solitarius Harold, 1869:124 (replacement name for *desertus* LeConte).

Agrilus canadensis Obenberger, 1917:181.

Description. Head bronzy green (♂) or coppery red (♀) in front; pronotum and elytra coppery red or green to bluish green or leaden; ventrally brassy coppery. Head weakly convex, usually without distinct impressions; surface rather densely, coarsely punctate, somewhat irregularly rugose; epistoma slightly transverse between antennae, broadly, deeply emarginate in front. Antennae serrate from fourth segment. Pronotum 0.6 times wider than long, widest near middle; sides weakly arcuate from apical angles to base; disc moderately convex, with 2 vague, median impressions, with broad, shallow, lateral impression on each side and distinct prehumeral carinae; surface coarsely, transversely rugose, finely, sparsely punctate between rugae. Elytra about equal in width at base and behind middle; sides weakly, broadly constricted in front of middle, weakly expanded behind middle, sinuate near the narrowly rounded, strongly serrulate apices; disc slightly flattened, without distinct costae, basal impressions deep; surface densely, coarsely, imbricate-punctate. Ventral surface obsoletely granulose, sparsely, finely punctate; pygidium sparsely, coarsely punctate, weakly carinate, carina not projecting; first abdominal sternite convex, without median impression. Tibiae slender, protibiae and mesotibiae each armed with short tooth on inner margin at apex (♂) or tooth absent (♀). Tarsal claws dissimilar, protarsal and mesotarsal claws cleft near tip, teeth about equal in length, inner tooth not turned inward, metatarsal claw cleft near middle, inner tooth much broader and shorter than outer (♂) or tarsal claws all similar, cleft near mid-



Map 76. Collection localities of *Agrilus politus*.

dle, inner tooth shorter and broader than outer (♀). Aedeagus as in Fig. 239. Length 4.7–8.5 mm.

Hosts. Reared from maple (*Acer* spp.) and willow (*Salix* spp.).

Distribution. Transcontinental across Canada and throughout the United States.

Comments. This is an extremely variable species and possibly contains a number of sibling species. To date, it is not possible to distinguish any segregates of this species except for the next two species.

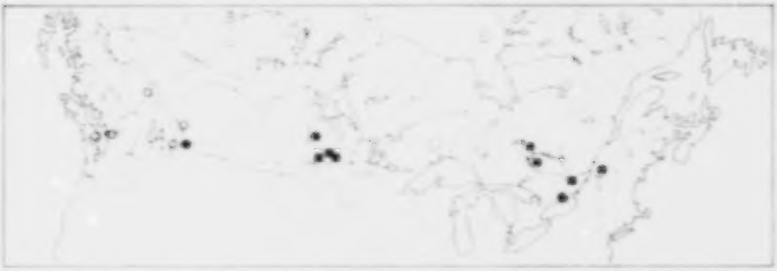
This species is apparently of little economic importance and nothing is recorded of its life history.

Agrilus pseudocoryli Fisher

Map 77

Agrilus politus pseudocoryli Fisher, 1928:218; Craighead 1950:192.

Description. As in *politus* except (in males) head, pronotum, and elytra coppery red, with violet tinge; protarsal and mesotarsal claws cleft closer to middle, inner tooth shorter, slightly broader than outer one, slightly turned inward. Females as in *politus*.



Map 77. Collection localities of *Agrilus pseudocoryli* (●) and *A. burkei* (○).

Hosts. Reared from hazel (*Corylus rostrata, C. cornuta, C. americana*).

Distribution. Quebec to Manitoba, south through the eastern United States.

Comments. I have doubts about the validity of this species but retain it as a full species for now. Males can be distinguished by the foregoing characters but no valid characters were found to differentiate females.

Agrilus burkei Fisher

Map 77

Agrilus burkei Fisher, 1917:287; Chamberlin 1926:56; Barr 1971:88.
Agrilus politus burkei: Fisher 1928:219.

Description. As in *politus* except color above is deep blue to bluish green. Length 6.0–9.0 mm.

Hosts. Reared from alder (*Alnus* spp.).

Distribution. British Columbia and Alberta, south through the western United States.

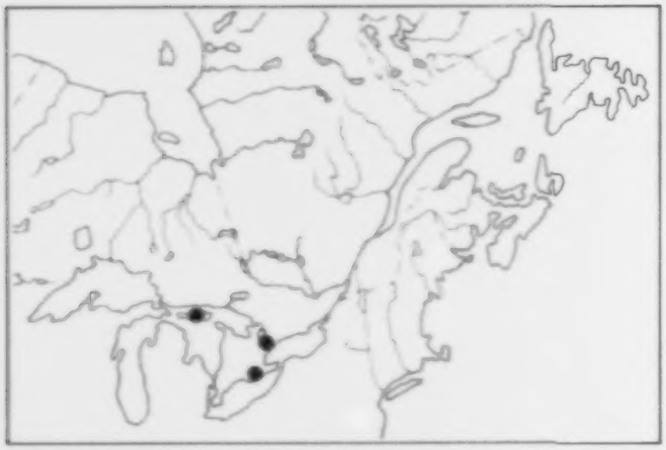
Comments. This form appears to merit full species status, although adults differ from *politus* only by color and host plant.

Detailed biological studies of this entire complex are needed to elucidate the systematics of the color and host forms encountered.

Agrilus cyanescens (Ratzeburg)

Fig. 240; Map 78

Buprestis coeruleus Rossi, 1792:62 (preoccupied).
Buprestis cyanescens Ratzeburg, 1837:54.
Agrilus coeruleus: Fisher 1928:224; Wellso et al. 1976:16.



Map 78. Collection localities of *Agrilus cyanescens*.

Several European synonyms are given in Fisher (1928).

Description. Uniformly dark blue to greenish blue above; ventrally black to bluish black. Head weakly convex, with distinct, broad, longitudinal impression extending from vertex to middle of frons; surface obsoletely granulose, coarsely, confluently punctate; epistoma slightly transverse between antennae, broadly, weakly emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.5 times wider than long, widest near apical third; sides arcuately rounded from apical angles to near middle; disc weakly convex, with more or less distinct, median impression in front of scutellum, with broad, moderately deep impression on each side along lateral margin, and with an elongate elevation in place of prehumeral carinae; surface densely, deeply rugose, rugae transverse on disc, and sparsely, finely punctate between rugae. Elytra about equal at base and behind middle; sides nearly parallel for a short distance behind base, broadly constricted in front of middle, arcuately expanded behind middle, obliquely narrowed to broadly rounded, weakly serrate apices; disc weakly convex, sutural margins slightly elevated, basal impressions moderately deep; surface densely, finely, imbricate-punctate. Ventral surface densely granulose, sparsely, finely punctate; pygidium coarsely punctate, strongly carinate but carina not projecting; first abdominal sternite weakly flattened. Tibiae slender, protibiae and mesotibiae with short tooth on inner margin at apex (♂) or all tibiae unarmed (♀). Tarsal claws all similar, cleft near middle, inner tooth much shorter than outer one and not turned inward. Aedeagus as in Fig. 240. Length 5.5–6.25 mm.

Hosts. Reported from Tartarian honeysuckle (*Lonicera tatarica*). In Europe, reported as breeding in *L. nigra*, oak (*Quercus* spp.), birch (*Betula* spp.), beech (*Fagus* spp.), alder (*Alnus* spp.), and rose (*Rosa* spp.).

Distribution. Occurs in Ontario, Massachusetts, Wisconsin, and Michigan. Limits of distribution not established.

Comments. This species has been introduced from Europe. It was first collected in the United States in 1920 from Wisconsin and in 1921 from Massachusetts. Wellso et al. (1976) include it in the key to Michigan Buprestide but give no locality date.

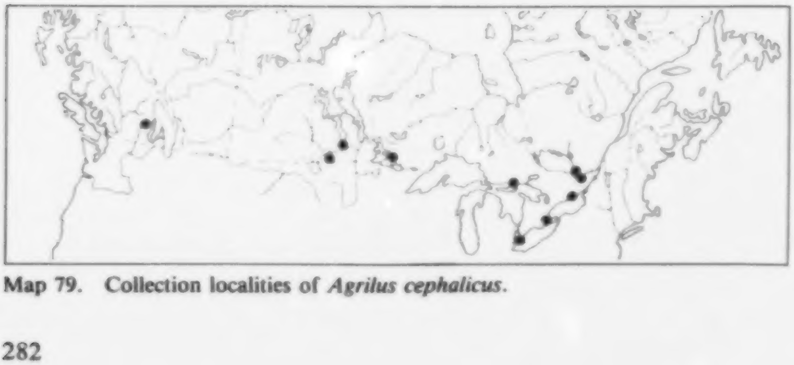
Adults of this species are similar to *pseudocoryli* and may be placed under that name in collections. Adults of *cyanescens* can be readily distinguished by having the terminal segments of the antennae as long as wide.

Agrilus cephalicus LeConte

Figs. 64, 241; Map 79

Agrilus cephalicus LeConte, 1860:260; Knull 1925:48; Chamberlin 1926:56; Fisher 1928:229; Craighead 1950:192.

Description. Head uniformly coppery brown (♀) or blue to bluish green, becoming brassy or coppery on occiput (♂); pronotum and elytra coppery brown to nearly black, the former sometimes bronzy green, slightly brassy laterally; ventrally black, with weak greenish tinge. Head nearly flat, with distinct, broad, longitudinal impression extending from vertex to middle of frons; surface finely, sparsely punctate, slightly rugose; epistoma transverse between antennae, broadly, not deeply arcuately emarginate in front. Antennae serrate from fourth segment. Pronotum about 0.3 times wider than long, widest near middle; sides arcuately rounded from apical angles to near base; disc moderately convex, with 2 round, moderately deep, median impressions, with broad, deep, oblique impression on each side along lateral margin at middle, and with strongly elevated prehumeral carinae; surface finely, densely granulate, transversely, coarsely rugose, finely, sparsely punctured between rugae. Elytra about equal in width at base and behind middle; sides nearly parallel for short distance behind base, weakly constricted in front of middle, broadly expanded behind middle, obliquely narrowed to broadly rounded, finely serrate apices; disc slightly flattened, without distinct longitudinal costae, basal impressions deep, broad; surface densely,



Map 79. Collection localities of *Agrilus cephalicus*.

coarsely, imbricate-punctate. Ventral surface obsoletely granulose, sparsely, finely punctate; pygidium coarsely, sparsely punctate, not carinate; first abdominal sternite weakly flattened, without median impression. Tibiae slender, with (♂) or without (♀) distinct tooth on inner margin at apex. Tarsal claws all similar, cleft near middle, inner tooth broad, shorter than outer one and not turned inward. Aedeagus as in Fig. 241. Length 4.5–5.8 mm.

Hosts. Reared from dogwood (*Cornus florida*).

Distribution. Southern Canada from British Columbia to Ontario and Quebec, south through the eastern United States to Texas.

Comments. Adults of this species vary from a uniform dark coppery brown to nearly black, with the pronotum various shades of bronzy green.

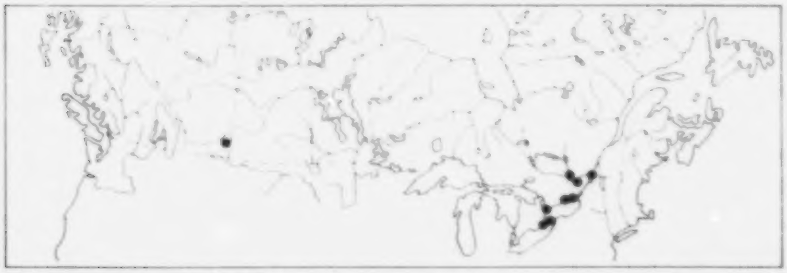
Nothing is known of the habits or life history of this species.

Agrilus crataegi Frost

Fig. 242; Map 80

Agrilus crataegi Frost, 1912:247; Knull 1925:48; Chamberlin 1926:57; Fisher 1928:226; Wellso et al. 1976:16.

Description. Head green in front, becoming coppery brown on occiput (♂) or entirely coppery (♀); pronotum and elytra greenish bronze, infused with copper, becoming coppery red on apical third of elytra; ventrally coppery red. Head nearly flat, with distinct longitudinal groove extending from occiput to middle of frons, ending in slight impression; surface finely, densely granulose, densely, coarsely punctate, longitudinally rugose on vertex; epistoma strongly transverse between antennae, broadly, deeply emarginate in front. Antennae serrate from fourth segment. Pronotum 0.5 times wider than long, widest along apical half; sides nearly parallel from apical angles to near middle, vaguely narrowed to posterior angles; disc moderately convex, with 2 broad, moderately deep, median impressions, with broad,



Map 80. Collection localities of *Agrilus crataegi*.

moderately deep impression on each side along lateral margin, and with long, sharp, prehumeral carinae; surface weakly reticulate, densely, transversely rugose, finely, sparsely punctate between rugae. Elytra about equal in width at base and behind middle; sides weakly rounded behind base, weakly, broadly constricted before middle, broadly expanded behind middle, obliquely narrowed to broadly rounded, finely serrulate apices; disc weakly convex, without distinct longitudinal costae, and with broad, deep, basal impressions; surface densely, coarsely, imbricate-punctate. Ventral surface weakly reticulate, densely, coarsely imbricate-punctate on basal abdominal segment; pygidium sparsely, coarsely punctate, weakly carinate, carina not projecting, first abdominal sternite weakly flattened, without median groove. Tibiae slender, with (♂) or without (♀) small tooth on inner margin at apex. Tarsal claws all similar, cleft near middle, inner tooth slightly shorter than outer tooth, not turned inward. Aedeagus as in Fig. 242. Length 6.0–8.0 mm.

Hosts. Reared from hawthorn (*Crataegus* spp.).

Distribution. Quebec to Alberta, south through the eastern United States.

Comments. The color is somewhat variable in different lights, varying from a reddish coppery to a greenish bronze with reddish reflections. Other notable variations are absent in the material studied.

Nothing is known of the habits or biology of this species.

Agrilus amelanchieri Knull

Fig. 243

Agrilus amelanchieri Knull, 1944:80; Wellso et al. 1976:16.

Description. Head greenish, becoming coppery on vertex; pronotum brilliant coppery; elytra purplish to black; ventrally coppery. Head slightly convex, slightly impressed on vertex; surface granulate on front, becoming weakly rugose on vertex; epistoma and antennae as in *crataegi*. Elytra, ventral surface, and tibiae as in *crataegi*. Tarsal claws as in *crataegi* except inner tooth stouter and slightly turned inward. Aedeagus as in Fig. 243. Length 5.0–6.0 mm.

Hosts. Reared from shad bush (*Amelanchier canadensis*).

Distribution. Not recorded from Canada but may occur in southern Ontario. Recorded from Pennsylvania and Michigan.

Comments. This species closely resembles *crataegi* but the adults of *amelanchieri* can be distinguished by the color of the head and pronotum, by the shape of the pronotum, and by the tarsal claws.

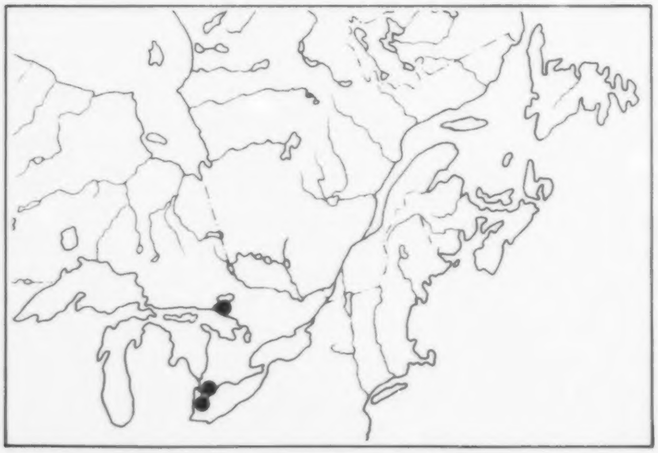
Nothing is known of the habits or biology of this species.

Agrilus subcinctus Gory

Fig. 244; Map 81

Agrilus subcinctus Gory, 1841:252; Knull 1925:50; Chamberlin 1926:83; Fisher 1928:299; Wellso et al. 1976:17.

Description. Head bright bronzy green in front, brownish coppery on vertex (♂) or entirely brownish coppery (♀); pronotum and elytra black, with strong brassy or coppery reflections, latter ornamented with pubescent designs; ventrally similar in color to pronotum and elytra. Head slightly convex, with narrow, longitudinal depression extending from vertex to epistoma, groove more deeply impressed on frons, triangular above epistoma; surface obsoletely granulate, sparsely, coarsely punctate, irregularly rugose; epistoma elevated, vaguely emarginate in front. Antennae serrate from fifth segment. Pronotum 0.3–0.5 times wider than long, widest near middle; sides nearly parallel or rounded from apical angles to basal third, narrowed to basal angles; disc moderately convex, with 2 deep, broad, median impressions, lateral impressions broad, deep, extending to base, prehumeral carinae absent; surface weakly granulose, coarsely rugose, rugae transverse at middle, irregular toward sides, finely punctate between rugae. Elytra equal in width at base and behind middle; sides nearly parallel for short distance behind base, weakly constricted in front of middle, broadly expanded behind middle, obliquely narrowed to broadly rounded, finely serrulate apices; disc slightly flattened, with broad, shallow, basal impressions; surface weakly granulose, densely, finely punctate, irregularly rugose, each elytron marked with whitish pubescent markings as follows: a stripe extending along sutural margin from basal impression to middle, turning obliquely outward toward lateral margin,



Map 81. Collection localities of *Agrilus subcinctus*.

and a broad, oblique fascia at apical fourth. Ventral surface finely, densely reticulate, finely, sparsely punctured; pygidium vaguely punctured, not carinate; first abdominal sternite weakly flattened at middle. Tibiae slender, protibiae and mesotibiae armed with feeble tooth on inner margin at apex (♂) or unarmed at apex (♀). Tarsal claws all similar, cleft near middle, inner tooth broad, shorter than outer one, not turned inward. Aedeagus as in Fig. 244. Length 3.5–4.5 mm.

Hosts. Breeds in ash (*Fraxinus pennsylvanica* var. *lanceolata*). Recorded from privet (*Ligustrum* spp.) by Wellso et al. (1976), and collected from foliage of poison ivy (*Toxicodendron* spp.).

Distribution. Ontario, south through the eastern United States to Texas and Florida.

Comments. The pubescent design on the elytra varies and may consist of an arcuate stripe extending from the basal impressions to the middle, and a broad, oblique fascia at apical fourth, or the stripe may be broken so as to form three or four small spots. Other variations are found in the shape and sculpture of the pronotum. The pronotal sides may be nearly parallel to strongly arcuate and may be from 0.3 to 0.5 times wider than long; the median impressions may also vary in depth.

Nothing is known of the habits or biology of this species.

Agrilus lecontei Saunders

Figs. 65, 245

Agrilus subfasciatus LeConte, 1860:245 (preoccupied).

Agrilus lecontei Saunders, 1871:117; Knull 1925:51; Chamberlin 1926:68; Fisher 1928:291; Wellso et al. 1976:17.

Description. Head light green, becoming coppery brown on vertex (♂) or uniformly dark coppery brown (♀); pronotum and elytra dark bronzy brown, with coppery tinge; elytra with pubescent designs; ventrally coppery brown. Head weakly convex, with weak, broad, longitudinal impression extending from epistoma to vertex, impression broader above epistoma; surface sparsely, coarsely punctate, coarsely rugose, rugae irregular but longitudinal on vertex; epistoma strongly transverse between antennae, broadly, shallowly emarginate in front. Antennae serrate from fifth segment. Pronotum about 0.5 times wider than long, widest at middle; sides weakly arcuate from apical angles to behind middle, then more strongly narrowed to base; disc moderately convex, with 2 broad, deep, median impressions weakly connected by narrow groove, with broad, moderately deep oblique impression on each side near lateral margin and with distinct, long, prehumeral carinae; surface coarsely, transversely rugose, finely punctate between rugae. Elytra about equal in width at base and behind middle; sides nearly parallel for short distance behind base, weakly constricted in front of middle, expanded behind middle, then obliquely narrowed to broadly rounded, strongly serrate apices; disc somewhat impressed along suture, with weak indications of costae on each side; surface weakly, coarsely, imbricate-punctate, each elytron with whitish pubescent design as follows: a broad, somewhat interrupted stripe extending along sutural margin from base to middle, then obliquely backward toward lateral margin, apical third vaguely pubescent, enclosing a glabrous spot near suture. Ventral surface sparsely, finely punctate, punctures connected by faint sinuate lines; pygidium coarsely punctate, weakly carinate, carina not projecting; first abdominal sternite slightly flattened at middle (♂) or convex at middle (♀). Tibiae slender, protibiae and mesotibiae armed with short tooth on inner margin near apex (♂) or unarmed at apex (♀). Tarsal claws dissimilar, anterior claws cleft near tip, each tooth about equal in length, middle and posterior claws cleft near middle, inner tooth broad, shorter than outer tooth and not turned inward (♂) or all tarsal claws similar, as in posterior claws of male (♀). Aedeagus as in Fig. 245. Length 4.0–6.0 mm.

Hosts. Reared from hackberry (*Celtis occidentalis*).

Distribution. Southern Ontario and the eastern United States as far south as Alabama.

Comments. Little variation is recorded for this species. The median impressions on the pronotum may vary slightly in depth, but they still preserve the form of two impressions connected by a groove.

Nothing is known of the habits or life history of this species.

Agrilus impexus Horn

Agrilus impexus Horn, 1891:327; Fisher 1928:262.

Description. Head bronzy green anteriorly (♂) or bronzy brown, becoming more or less coppery on occiput (♀); pronotum and elytra coppery and each elytron with 3 pale yellow pubescent spots; ventrally bronzy green, with weak coppery reflection. Head wide, broadly, rather deeply concave on vertex and with weak median groove extending from occiput to epistoma; surface sparsely, coarsely punctate, irregularly rugose and densely (♂) to sparsely (♀) clothed with long, recumbent, yellowish setae; epistoma slightly transverse between antennae, broadly, rather deeply, arcuately emarginate in front. Antennae serrate from fifth segment. Pronotum nearly as long as wide, widest near middle; sides vaguely arcuate from apical angles to behind middle, then strongly narrowed to base, where they are strongly sinuate; disc moderately convex, with 2 broad, vague, median impressions, with broad, deep, oblique impression laterally along lateral margin, and with obtusely rounded, long, sinuate prehumeral carinae; surface obsoletely granulose, densely, coarsely rugose, finely punctate between rugae. Elytra about equal in width at base and behind middle; sides weakly, broadly constricted near middle, broadly arcuately expanded behind middle, then narrowed to narrowly rounded, strongly serrulate tips; disc slightly flattened, sutural margins elevated posteriorly, with broad, moderately deep, basal impressions; surface coarsely, densely imbricate-punctate. Each elytron with 3 sparsely pubescent spots as follows: one in basal impression, an elongate one before middle, and one at apical third. Ventral surface obsoletely granulose, densely, finely punctate; pygidium weakly carinate, carina not projecting; first and second abdominal sternites weakly sulcate (♂) or convex (♀) at middle. Tibiae slender, protibiae and mesotibia armed with short tooth on inner margin at apex (♂) or unarmed (♀). Tarsal claws all similar, cleft near middle, inner tooth broad, shorter than outer and not turned inward. Length 6.5–7.5 mm.

Hosts. Larval host unknown.

Distribution. South Dakota and Minnesota, south to Mississippi and west to Wyoming and Arizona. May occur in southern portions of the Prairie Provinces.

Comments. Fisher (1928) reports that little variation was observed in this species with the exception of color. The color varies from olivaceous green to reddish coppery and occasionally a specimen is seen with a distinct bluish cast.

Adults of this species have been recorded from honey-locust (*Gleditsia triacanthos*) and black locust (*Robinia pseudoacacia*), but these records are probably from incorrectly identified specimens of *pseudofallax*.

This species is included herein based on a statement by Dr. G. H. Nelson (pers. comm. 1983) "... ex SD and MN."

Agrilus addendus Crotch

Agrilus addendus Crotch, 1873:95; Fisher 1928:267.

Description. Similar to *impexus* except differs by being smaller (4.0–6.0 mm) and by the elytra being more uniformly pubescent posteriorly, with elytral spots not distinct, often obsolete, and basal and median spots usually connected and forming a more or less distinct stripe on basal half of elytra.

Hosts. Unknown.

Distribution. North Dakota to Texas, west to Arizona. May occur in southern portions of the Prairie Provinces.

This species is included herein based on a North Dakota record provided by Dr. G. H. Nelson (pers. comm. 1983).

Agrilus pseudofallax Frost

Fig. 246

Agrilus pseudofallax Frost, 1923:279; Knull 1925:51; Chamberlin 1926:79; Fisher 1928:284; Wellso et al. 1976:17.

Description. Head bronzy green, becoming coppery brown on vertex (♂), or uniformly mahogany red (♀); pronotum and elytra dark brown, with coppery or brassy tinge, each elytron with 3 distinct pubescent spots; ventrally brownish coppery. Head nearly flat, with weakly indicated median groove on vertex; surface finely, densely granulose, sparsely, coarsely punctured, transversely rugose above epistoma; epistoma scarcely transverse between antennae, broadly, deeply, arcuately emarginate in front. Antennae serrate from fifth segment. Pronotum about 0.25 times wider than long, widest near middle; sides weakly arcuate from apical angles to behind middle, then more strongly narrowed to basal angles; disc moderately convex, with broad, elongate, median impression, somewhat interrupted at middle, slightly deeper posteriorly, with broad, deep, oblique impression on each side along lateral margin, and with straight, vague, obtuse prehumeral carinae; surface weakly granulose, strongly, transversely rugose, finely punctured between rugae. Elytra about equal in width at base and behind middle; sides nearly parallel for short distance behind base, weakly constricted in front of middle, broadly expanded behind middle, obliquely narrowed to narrowly rounded, weakly serrate apices; disc weakly, longitudinally concave along sutural margins, with shallow basal impressions; surface coarsely, densely imbricate-punctate, each elytron with 3 round, yellowish pubescent spots, one in basal impression, one in front of middle, and one at apical third. Ventral surface finely, sparsely punctate, punctures connected by distinct sinuate lines; pygidium sparsely, coarsely punctate, not distinctly carinate; first abdominal sternite flattened or slightly concave in middle (♂) or convex at middle (♀). Tibiae slender, protibiae and mesotibiae each armed with short tooth on inner margin at apex (♂) or tibiae unarmed (♀). Tarsal claws all similar, cleft near middle, inner tooth broad, shorter than outer tooth, not turned inward. Aedeagus as in Fig. 246. Length 4.5–6.3 mm.

Hosts. Wellso et al. (1976) record this species from honey-locust (*Gleditsia triacanthos*), but whether it was reared from this host is not stated. The species has also been collected on oak (*Quercus* spp.).

Distribution. Eastern United States as far north as Michigan. Not yet recorded from Canada but should occur in southern Ontario.

Comments. Nothing is known of the habits or life history of this species.

Agrilus egeniformis Champlain & Knull

Fig. 247

Agrilus egeniformis Champlain and Knull, 1923*b*:84; Knull 1925:51; Chamberlin 1926:59; Fisher 1928:186; Wellso et al. 1976:17.

Description. Similar to *pseudofallax* but differs by having the indistinct pubescent spots on elytra, the elongate median spots, the feeble median depression on the pronotum, the bronzy green frons of the female, and the strongly, arcuately expanded sides near the apex of the lateral lobes of the aedeagus (Fig. 247).

Hosts. Collected on honey-locust (*Gleditsia triacanthos*).

Distribution. Eastern United States, north to Michigan; not yet recorded in Canada but probably occurs in southern Ontario.

Comments. Nothing is known of the habits or life history of this species.

Agrilus olentangyi Champlain & Knull

Fig. 248

Agrilus olentangyi Champlain and Knull, 1925:469; Fisher 1928:239; Wellso et al. 1976:17.

Description. Similar to *lacustris* but differs by the broadly, deeply emarginate prosternal lobe. Aedeagus as in Fig. 248.

Hosts. Wellso et al. (1976) give hackberry (*Celtis occidentalis*) as the host plant, but whether the species was reared from this host or only collected on it is not clear. Adults have been collected on oak (*Quercus* spp.).

Distribution. Eastern United States, north to southern Michigan, south to Texas and Mississippi; not yet recorded in Canada but may occur in southern Ontario.

Comments. This species is included here because of one record in Lenawee County, which is situated in the most southerly part of Michigan. Since the host plant occurs in southern Ontario, it is reasonable to assume that this species may also occur there.

Agrilus malvastri Fisher

Fig. 249

Agrilus malvastri Fisher, 1928:247.

Description. Body bronzy green to coppery brown, with bluish or brassy tinge, each elytron with vague pubescent stripe. Head nearly flat, with shallow groove extending from epistoma to vertex; surface coarsely, irregularly rugose, sparsely, finely punctate; epistoma narrow between antennae, broadly, arcuately emarginate in front. Antennae serrate from fifth segment. Pronotum wider than long, widest along apical half; sides nearly parallel or weakly rounded from apical angles to near base, strongly sinuate at base,

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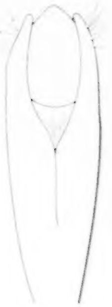
Figs. 248–257. Aedeagi of *Agrilus* spp. (248–251, 253, 254, 257 redrawn from Fisher 1928; 252, 255, 256 redrawn from Knull 1925, 1972). 248, *A. olentangyi*; 249, *A. malvastri*; 250, *A. putillus*; 251, *A. lacustris*; 252, *A. imbellis*; 253, *A. parvus*; 254, *A. paracelti*; 255, *A. egenus*; 256, *A. celti*; 257, *A. bilineatus bilineatus*.



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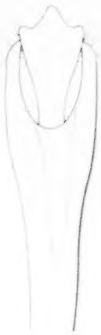

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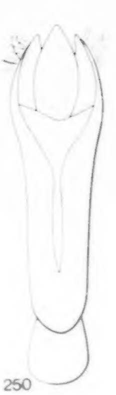

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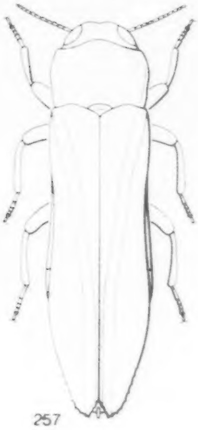

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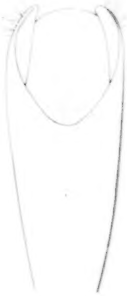

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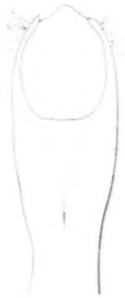

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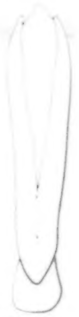

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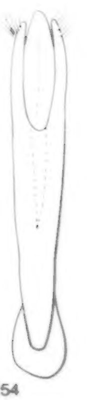

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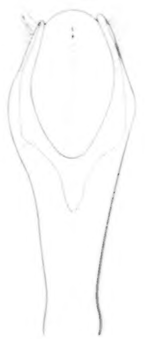

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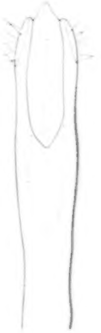


256

posterior angles rectangular; disc strongly convex, with vague median depression anteriorly, with broad, oblique depression on each side along lateral margin, extending from apical fourth to base, and with distinct, obtruse, prehumeral carinae; surface coarsely, densely scabrous, sparsely, finely punctate. Elytra equal in width at base and apical third; sides nearly parallel for short distance behind base, broadly, weakly constricted before middle, broadly expanded behind middle, obliquely narrowed to narrowly rounded, weakly serrate apices; disc weakly flattened, broadly depressed along sutural margin; basal impressions broad, shallow; surface densely imbricate-punctate, each elytron with weakly indicated stripe of whitish setae extending from basal impressions to apex. Ventral surface sparsely, finely punctate, punctures connected by sinuate lines; pygidium sparsely punctate, weakly, longitudinally carinate, carina not projecting; first abdominal sternite slightly flattened at middle (♂) or convex at middle (♀). Tibiae slender, protibiae and mesotibiae each with small tooth on inner margin at apex (♂) or all tibiae unarmed at apex (♀). Tarsal claws all similar, cleft near middle, inner tooth shorter than outer one, not turned inward. Aedeagus as in Fig. 249. Length 4.5–7.0 mm.

Hosts. Collected on *Malvastrum coccineum* and on *Sphaeralcea* spp.

Distribution. Southern Alberta through the western United States to Texas.

Canadian records. Medicine Hat and Lethbridge, Alta.

Comments. Adults of this species vary in color from bronzy green to coppery brown and with white to yellowish white pubescence. The impressions on the head and pronotal disc vary in depth and distinctness. Other prominent variations were not noticed.

Nothing is known of the habits or life history of this species.

Agrilus putillus Say

Fig. 250

Agrilus putillus Say, 1839:163; Knull 1925:50; Chamberlin 1926:79; Fisher 1928:331; Wellso et al. 1976:17.

Description. Head dark bronzy green in front (♂) or uniformly coppery brown (♀); remainder of body black. Head weakly flattened, with broad, weak, longitudinal groove on vertex; surface densely, finely granulose, weakly transversely rugose on frons, longitudinally rugose on occiput; epistoma slightly transverse between antennae, broadly, deeply emarginate in front. Antennae serrate from fifth segment. Pronotum about 0.6 times wider than long, widest along apical half; sides nearly parallel and slightly sinuate from apical angles to basal third, then obliquely narrowed to basal angles; disc moderately convex, with broad, shallow, transverse impression behind middle, with large, deep impression on each side along lateral margin at middle, and prehumeral carinae absent; surface coarsely, transversely rugose, with numerous fine punctures between rugae. Elytra wider at apical third than at base; sides nearly parallel to behind middle, arcuately expanded, then obliquely narrowed to the broadly rounded, weakly serrulate apices; disc weakly impressed along suture, basal impression broad, shallow, and with more or less distinct costae on each elytron; surface coarsely imbricate-punctate. Ventral surface sparsely, finely punctate; pygidium not carinate; first abdominal sternite convex at middle. Tibiae slender, protibiae and mesotibiae each with small tooth on inner margin at apex (♂) or all tibiae unarmed at apex (♀). Tarsal claws all similar, cleft near middle, outer tooth long, acute, inner tooth broad, not turned inward. Aedeagus as in Fig. 250. Length 3.5–4.5 mm.

Hosts. Collected on maple (*Acer* spp.).

Distribution. Southern Ontario, south through the eastern United States to at least Pennsylvania and Missouri.

Canadian records. Prince Edward County and Arnprior, Ont.

Comments. Some variation can be seen in adults of this species. The color is usually constant, but some individuals are slightly more coppery than others. The pronotal sides vary from slightly arcuate to straight. The discal costae on the elytra vary from vague to nearly absent.

Nothing is known about the habits or life cycle of this species.

Agrilus lacustris LeConte

Fig. 251

Agrilus lacustris LeConte, 1860:250; Chamberlin 1926:67; Fisher 1928:305.
Agrilus cuneus LeConte, 1866:384.
Agrilus pubiventris Crotch, 1873:95.

Description. Body uniformly dark brown or bronzy brown through various shades of green, occasionally blue, with bronzy or coppery tinge. Head weakly convex, without longitudinal groove or groove vague on vertex; surface strongly, irregularly rugose, obsoletely granulose; epistoma not transverse between epistoma, broadly, shallowly emarginate. Antennae serrate from fifth segment. Pronotum slightly wider than long, widest at apical third; sides rounded from apical angles to basal fourth, strongly sinuate to posterior angles; disc strongly convex, without distinct median impression or median impression very weak, with deep, elongate lateral impressions, and with weakly indicated prehumeral carinae; surface coarsely, closely, transversely rugose, finely, sparsely punctate between rugae. Elytra about equal in width at base and behind middle; sides nearly parallel for short distance behind base, broadly, arcuately constricted near middle, weakly expanded behind middle, obliquely narrowed to broadly rounded, strongly serrulate apices; disc slightly flattened, basal impressions broad, shallow; surface densely, coarsely imbricate-punctate. Ventral surface finely, irregularly striolate, finely, sparsely punctured; pygidium weakly, longitudinally carinate, carina not projecting; first and second abdominal sternites broadly, longitudinally concave, concavity densely clothed with long, semierect, white setae (♂) or segments convex at middle, glabrous (♀). Tibiae slender, protibiae and mesotibiae armed with short, straight tooth on inner margin at apex (♂) or all tibiae unarmed at apex (♀). Tarsal claws similar on all tarsi, cleft near base, outer tooth long, acute, inner tooth very broad, about half as long as outer one, not turned inward. Aedeagus as in Fig. 251. Length 4.0–7.5 mm.

Hosts. Common on *Croton* spp.

Distribution. Recorded from southern Ontario, Texas, New Mexico, Arizona, California, Illinois, Wisconsin, Kansas, and Oklahoma.

Canadian record. Grimsby, Ont.

Comments. This species is included because of the record from southern Ontario and the fact that the type is from the Lake Superior region. More collecting is needed to definitely establish its presence or absence in Canada.

Adults of this species vary in color from a bronzy brown through various shades of green, with an occasional blue specimen. The brownish specimens seem to occur in more northerly locations. Other more obvious variations are mentioned in the foregoing description.

This species and *imbellis* are easily recognized by the distinct band of white pubescence extending from the anterior edge of the prosternum to the second abdominal sternite of the male. Distinguishing the two species may be difficult. In adults of *lacustris*, the ventral margin of the eyes is more acutely rounded and the posterior tarsi of the male are longer than the tibiae.

Nothing is known of the habits or life history of this species.

Agrilus imbellis Crotch

Fig. 252

Agrilus imbellis Crotch, 1873:94; Knull 1925:53; Chamberlin 1926:65; Fisher 1928:308.

Description. Similar to *lacustris*. See comments. Aedeagus as in Fig. 252.

Hosts. Larval habits unknown. Adults collected on frostweed (*Helianthemum canadenses* and *H. rosmarinifolium*) and black locust (*Robinia pseudoacacia*) (latter record may refer to another species).

Distribution. Southern Ontario through Atlantic States to Alabama.

Canadian record. Ojibway, Ont.

Comments. Adults of this species are similar to those of *lacustris*.

Adults of *imbellis* may be distinguished by the more broadly rounded, ventral margin of the eye and by the posterior tarsi of the male being equal in length to the tibiae.

Nothing is known of the habits or life history of this species.

Agrilus parvus Saunders

Fig. 253

Buprestis pusilla Say, 1825:252 (preoccupied by the *Buprestis pusilla* Olivier, 1790).

Agrilus pusillus: Knull 1925:53; Chamberlin 1926:76; Fisher 1928:317; Wellso et al. 1976:17.

Agrilus parvus Saunders, 1871:116 (replacement name for *pusilla* Say, not Olivier).

Description. Head and pronotum brassy or coppery, head usually green in front, pronotum more reddish on median part (♂) or head more coppery (♀); elytra purplish black; ventrally black, with strong brassy tinge. Head moderately convex, with weak, broad, longitudinal groove extending from epistoma to vertex; surface densely, finely granulose, with few coarse punctures intermixed, longitudinally rugose on vertex; epistoma narrow between antennae, broadly, shallowly emarginate in front. Antennae serrate from fifth segment. Pronotum about 0.25 times wider than long, widest at middle or near apical angles; sides obliquely or weakly narrowed from apex to posterior angles; disc moderately convex, with broad, transverse impression before base, with deep impression on each side along lateral margin near middle, and with distinct, straight prehumeral carinae; surface coarsely, transversely rugose, obsoletely granulose, sparsely punctate between rugae. Elytra equal in width at base and behind middle; sides parallel for short distance behind base, weakly constricted before middle, broadly expanded behind middle, then obliquely narrowed to broadly rounded, finely serrulate apices; disc slightly flattened, basal impressions very shallow, broad; surface coarsely imbricate-punctate. Ventral surface finely, transversely striolate, sparsely, finely punctate; pygidium not carinate; first and second abdominal sternites weakly, broadly, longitudinally concave (♂) or first two abdominal sternites convex (♀). Tibiae slender, protibiae and mesotibiae armed with short tooth on inner margin at apex (♂) or all tibiae unarmed at apex (♀). Tarsal claws similar on all tarsi, cleft near middle, outer tooth long, acute, inner tooth broad, about half as long as outer tooth, not turned inward. Aedeagus as in Fig. 253. Length 3.2–4.8 mm.

Hosts. Larval habits unknown. Collected in Nebraska and Texas on false indigo (*Amorpha fruticosa*).

Distribution. Southern Manitoba, south through midwestern United States to Texas, east to Pennsylvania and Alabama, west to Colorado.

Canadian record. Winnipeg, Man.

Comments. This species closely resembles *egenus* and *celti* and there may be some difficulty in distinguishing the bronzy green females. Males can be most easily distinguished by the characters of the aedeagus.

When Say (1825) described this species as *Buprestis pusilla*, a homonym was created with *Buprestis pusilla* Olivier. Saunders (1871) recognized the homonym and renamed Say's species *Agrilus parvus*. This is the correct name for this species, even though Say's and Olivier's species have been transferred to other genera and later authors continued to use *pusillus* (Say).

Agrilus paracelti Knull

Fig. 254

Agrilus paracelti Knull, 1972:113; Wellso et al. 1976:17.

Description. Head metallic green, becoming dark coppery on vertex (♂) or head entirely coppery (♀); pronotum and elytra dark coppery; ventrally darker. Head flat, without median impression; surface densely, finely granulose, becoming rugose on vertex. Antennae serrate from fifth segment. Pronotum slightly wider than long, widest at middle; sides obliquely rounded in front, slightly sinuate near base; disc convex, with broad, shallow impression in front of scutellum, with less marked one in front of it, with lateral impression on each side along margin, and with sharp prehumeral carinae; surface weakly transversely rugose, finely punctate between rugae. Elytra equal in width at base and behind middle; sides subparallel for short distance behind base, constricted in front of middle, broadly expanded behind middle, then obliquely narrowed to broadly rounded, serrulate apices; disc slightly flattened, basal impressions broad, deep, and slight median impression on basal half of each elytron and with vague stripe of pubescence in middle of each elytron; surface imbricate-punctate. Ventral surface finely, sparsely punctate; pygidium longitudinally carinate, carina not projecting; first abdominal sternite flattened at middle. Tibiae slender, protibiae and mesotibiae each with tooth on inner margin at apex (♂) or all tibiae unarmed at apex (♀). Tarsal claws similar on all tarsi, cleft near middle, inner tooth broad and much shorter than outer tooth, not turned inward. Aedeagus as in Fig. 254. Length 4.5 mm.

Hosts. Reared from hackberry (*Celtis occidentalis*).

Distribution. Eastern United States, west to Colorado and Texas; not yet recorded in Canada but may occur in southern Ontario.

Comments. This species is included here based on the Michigan occurrence reported by Wellso et al. (1976). The host plant occurs in southern Ontario and it is reasonable to assume that this species occurs there also. This species is also recorded from North Dakota; therefore it may also occur in southern Manitoba and Saskatchewan.

Adults of this species may be confused with *celti* but *paracelti* may be distinguished by the line of pubescence down the middle of each elytron.

Nothing is known of the habits or life history of this species.

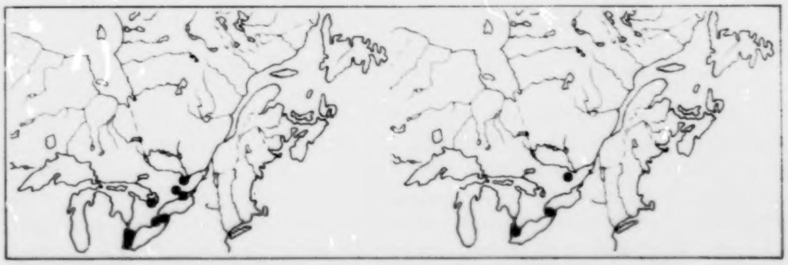
Agrilus egenus Gory

Figs. 46, 255; Map 82

Agrilus egenus Gory, 1841:258; Knull 1925:42; Chamberlin 1926:59; Fisher 1928:325; Craighead 1950:192; Wellso et al. 1976:17.

Description. Head light green, with slight brassy tinge (♂) or bronzy green (♀); pronotum and elytra brownish bronze or greenish bronze; ventrally slightly more greenish. Head nearly flat, with weak, narrow, longitudinal groove on vertex; surface densely, coarsely granulose on frons, with numerous large punctures intermixed, longitudinally rugose on vertex; epistoma wide between antennae, broadly, deeply emarginate in front. Antennae serrate from fifth segment. Pronotum 0.3 times wider than long, widest near middle; sides nearly parallel or weakly rounded to basal fourth, then weakly narrowed to posterior angles; disc moderately convex, with one or two round, weak impressions placed longitudinally on median part, with large, deep impression on each side along lateral margin, and with strongly elevated prehumeral carinae; surface coarsely, transversely rugose, finely, densely granulose, with numerous fine punctures between rugae. Elytra about equal in width at base and behind middle; sides parallel for short distance behind base, weakly constricted near middle, broadly expanded behind middle, obliquely narrowed to broadly rounded, finely serrulate apices; disc weakly impressed along sutural margins, basal impression broad, moderately deep; surface coarsely imbricate-punctate. Ventral surface densely, finely punctate, irregularly striolate laterally; pygidium with smooth median line, not carinate; first two abdominal sternites broadly, longitudinally concave at middle, densely clothed with long, white setae (♂) or first two abdominal sternites convex, without long pubescence (♀). Tibiae slender, protibiae and mesotibiae armed with small tooth on inner margin at apex (♂) or all tibiae unarmed at apex (♀). Tarsal claws similar on all tarsi, cleft near middle, outer tooth long, acute, inner tooth broad, about half as long as outer tooth, not turned inward. Aedeagus as in Fig. 255. Length 3.5–5.5 mm.

Hosts. Reared from black locust (*Robinia pseudoacacia*).



Maps 82, 83. 82, Collection localities of *Agrilus egenus*; 83, *A. celti*.

Distribution. Eastern Canada, south through the eastern and southeastern United States.

Comments. Adults of this species may be confused in collections with *otiosus* but can be readily distinguished by the antennal characters. Among those species with the antennal serration beginning with the fifth segment, adults of *egenus* are most like those of *celti*. Females of the two cannot be adequately separated; males can be separated only by characters of the aedeagus.

Adults vary in color from coppery brown to greenish bronze with all intermediate shades. Other variations in sculpture of the pronotum and pubescence can be noted but these are generally minor and are considered in the description.

Nothing is known of the biology or habits of this species.

Agrilus celti Knull

Fig. 256; Map 83

Agrilus celti Knull, 1920:11; Knull 1925:52; Chamberlin 1926:56; Fisher 1928:322; Wellso et al. 1976:17.

Description. As in *egenus* except aedeagus with sides of lateral lobes parallel (Fig. 256).

Hosts. Reared from hackberry (*Celtis occidentalis*).

Distribution. Southern Ontario, south through eastern United States, east to North Dakota and Oklahoma.

Comments. This is a distinct species but cannot be distinguished from *egenus* except by characters of the aedeagus and by the host plant.

Nothing is known of the habits or life history of this species.

Genus *Pachyschelus* Solier

This is a rather large genus, especially rich in New World species. Nicolay and Weiss (1920) recorded only three North American species (and one variety); Blackwelder (1983) listed seven species and Wellso et al. (1976) described an additional species.

The larvae are leaf miners in various herbaceous plants.

Description. Head strongly convex, with narrow, longitudinal impression along median line; surface sparsely punctured, micro-reticulate, with pair of deep pores just above antennal insertions; mouthparts concealed under anterior edge of prosternum. Antennae short, first and second segments more elongate, segments 3-11 shorter, more rounded, lying in repose in groove on prosternum and on pronotum. Pronotum wider than long, ventrally grooved for reception of antennae; posterior margin straight to weakly sinuate;

surface smooth, with sparse, very faint, large, shallow punctures. Scutellum very large, triangular, acute posteriorly. Elytra broad at base, sides strongly converging to very narrowly rounded apex; surface smooth, densely, randomly, shallowly punctured. Prosternum broad, almost truncate posteriorly. Legs broad, fitting snugly into body grooves when retracted. Last visible abdominal sternite of female bilobed with 3 or 4 sharp teeth on each lobe; last visible abdominal sternite of male smooth.

Comments. This genus was reviewed by Nicolay and Weiss (1920). Wellso et al. (1976) recognized three species from Michigan, all of which occur or may occur in Canada.

Key to species of *Pachyschelus* in Canada

1. Each elytron with oblique line of white pubescence just before apex, elytra metallic blue to purple; last visible abdominal sternite of female with 3 small teeth; Alberta and Ontario .... ***purpureus*** **(Say)** (p. 299)
   Elytra glabrous, shining black; last visible abdominal sternite of female bilobed, with 4 small teeth on each lobe 2
2. Lateral lobes of aedeagus evenly rounded to apex (Fig. 244); host: *Desmodium* spp.; Ontario and Quebec .... ***laevigatus*** **(Say)** (p. 299)
   Lateral lobes of aedeagus broadly expanded before apex (Fig. 245); host; *Lespedeza* spp.; Ontario .... ***confusus*** **Wellso & Manley** (p. 303)

Tableau des espèces de *Pachyschelus* du Canada

1. Chaque élytre avec une ligne oblique formée d'une pubescence blanche juste avant l'apex, élytres bleu métallique à violets; dernier sternite abdominal visible de la femelle avec 3 petites dents; Alberta et Ontario .... ***purpureus*** **(Say)** (p. 299)
   Élytres glabres, noir luisant; dernier sternite abdominal visible de la femelle bilobé, avec 4 petites dents sur chaque lobe 2
2. Lobes latéraux de l'édéage régulièrement arrondis jusqu'à l'apex (fig. 244); hôte : *Desmodium* spp.; Ontario et Québec .... ***laevigatus*** **(Say)** (p. 299)
   Lobes latéraux de l'édéage très élargis avant l'apex (fig. 245); hôte : *Lespedeza* spp.; Ontario .... ***confusus*** **Wellso & Manley** (p. 303)

Pachyschelus purpureus (Say)

Fig. 259

Metonius purpureus Say, 1839:164.
Pachyschelus purpureus: Nicolay and Weiss, 1920:138; Knull 1925:54; Chamberlin 1926:223; Wellso et al. 1976:17.

Description. Head and pronotum shining black; elytra black with distinct bluish or purplish reflections and with oblique, narrow band of whitish pubescence just before apex. Head strongly convex, longitudinal impression very weak; surface weakly shining, with few, widely separated, weakly impressed, very small punctures. Pronotum about 3.0 times wider than

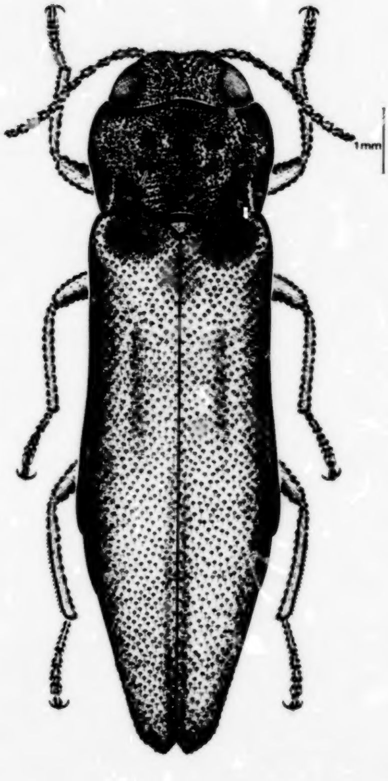
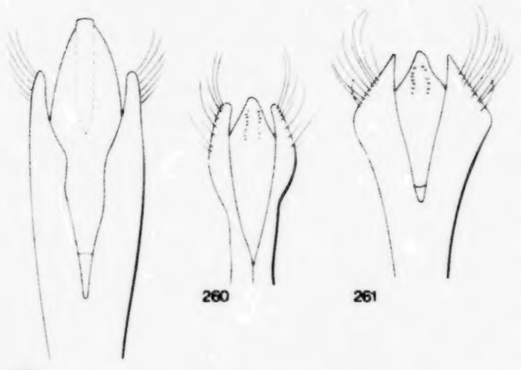


Fig. 258. *Agrilus anxius*.

long, widest at apical angles; sides strongly converging toward anterior angles; disc weakly, evenly convex; surface shining, densely, minutely reticulate, with very widely separated, shallow punctures. Elytra widest at base; sides strongly converging to narrowly rounded apex; humeral angles slightly elevated, and with a slight impression just behind humeri; surface densely, randomly punctured, punctures much closer and deeper than those on pronotum; each elytron with an oblique, narrow band of white setae extending from middle of elytron to lateral margin just before apex, sometimes with several additional small patches of pubescence slightly above center near the suture. Ventral surface finely, sparsely punctured; last visible abdominal sternite smooth along apical margin, triangular (♂) or bilobed at apex, each lobe with 3 acute denticles (♀). Tibiae flattened. Aedeagus as in Fig. 259. Length 2.8–3.5 mm.

Hosts. Reared from bush-clover (*Lespedeza* spp.). Chamberlin (1926) gives the host as geranium (*Geranium maculatum*) and taken on poison ivy (*Rhus toxicodendron*).



Figs. 259–261. Aedeagi of *Pachyschelus* spp. (redrawn from Wellso et al. 1976). 259, *P. purpureus*; 260, *P. laevigatus*; 261, *P. confusus*.

Distribution. Alberta, Ontario, New England States, east to Iowa, south to Texas and New Mexico.

Canadian records. Cypress Hills, Alta., and Campden, Ont.

Comments. Adults of this species are easily distinguished from the other species of the genus that occur in Canada by the bluish or purplish reflection on the elytra, by the characters of the last visible abdominal sternite of the female, and by the fact that it is the only species of the genus in Canada with white pubescence on the elytra.

Nothing is known of the habits or life history of this species except that it may be collected by sweeping marshy areas in the spring. The larvae live in leaves of bush-clover.

Pachyschelus laevigatus (Say)

Figs. 260, 262; Map 84

Trachys ovatus Say, 1825:252 (preoccupied).

Trachys laevigatus Say, 1839:164 (replacement name).

Pachyschelus laevigatus: Nicolay and Weiss 1920:139; Knull 1925:55; Chamberlin 1926:222; Wellso et al. 1976:17.

Brachys punctata Gory, 1841:347.

Metonius oblongus Motschulsky, 1860:54.

Pachyschelus politus Kerremans, 1896:322.

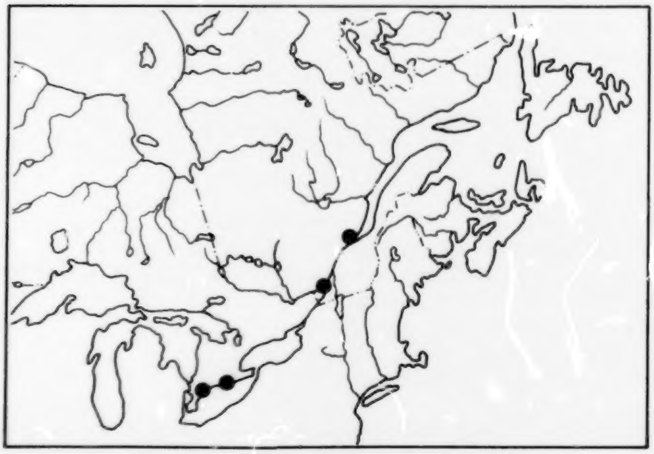
Description. Head, pronotum, and elytra shining black, glabrous except for a few scattered, recumbent setae. Head convex, with weak, longitudinally impressed line on frons; surface with few weakly impressed scattered punctures. Pronotum about 3.0 times longer than wide, widest at base; sides arcuate, converging from base to apex; disc evenly convex; surface shining, with scattered, small, weakly impressed punctures, each puncture bearing a recumbent seta. Elytra widest at base; sides arcuate from base to the narrowly rounded apex; surface densely, randomly punctured, punctures much closer and deeper than on pronotum. Ventral surface finely, sparsely punctured; last visible abdominal sternite obtusely rounded with small spine at apex (♂) or bilobed at apex, each lobe with 4 acute teeth (♀). Tibiae flattened. Aedeagus as in Fig. 260. Length 2.0–2.5 mm.

Hosts. Reared from leaves of tick trefoil (*Desmodium canadenses*). Reported by Chamberlin (1926) mining foliage of black gum (*Nyssa sylvatica*), black hawthorn (*Crataegus douglasii*), milkweed (*Asclepias* spp.), bush-clover (*Lespedeza virginica* and *L. bicolor*), and tick trefoil (*Desmodium obtusa, D. viridiflora*, and *D. canadenses*). Some of these records may be erroneous or may represent hosts of other species. Wellso et al. (1976) give the host as *Desmodium*.

Distribution. Ontario and Quebec, south to Florida, west to Arkansas and Kansas.

Comments. Adults of this species are easily distinguished from *purpureus* by the lack of pubescence on the elytra, by the uniform black color, and by the presence of four teeth on each lobe on the apex of the last visible abdominal sternite of the female. From *confusus*, adults of *laevigatus* can be distinguished with certainty only by characters of the aedeagus.

Nothing is known of the habits or life history of this species.



Map 84. Collection localities of *Pachyschelus laevigatus*.

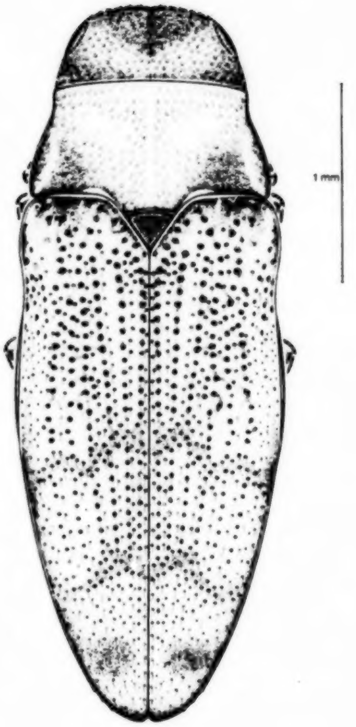


Fig. 262. *Pachyschelus laevigatus.*

Pachyschelus confusus Wellso & Manley

Fig. 261

Pachyschelus confusus Wellso and Manley, 1976:17.

Description. Form, size, and color as in *laevigatus*. Distinguishable by characters of the aedeagus (Fig. 261).

Hosts. Reared from bush-clover (*Lespedeza* spp.).

Distribution. Known definitely only from Michigan and Minnesota, but female specimens that may be this species have been seen from southern Ontario.

Canadian records. Normandale, Ont., reared from *Lespedeza*; Fonthill, Ont., feeding on leaves of bush-clover.

Comments. Adults of this species are indistinguishable from those of *laevigatus* except for the characters on the aedeagus (Fig. 261). The host plant difference may be significant.

Other than the host plant, nothing is known about the habits or biology of this species.

Genus *Brachys* Solier

This genus is rich in species in the tropical regions of the New World. Eleven species are recorded from the United States and only three of these reach Canada.

Little is known of the life history of members of this genus, but probably most of them are leaf miners in the larval stage and leaf feeders as adults. Records indicate that broad-leaved trees serve exclusively as hosts.

A great deal of variation in size and color is encountered in our species. The following key should enable one to identify most species encountered but extra care may be required to identify some specimens.

Description. Head convex, longitudinally impressed, with more or less distinct, flattened, glabrous tubercle near each eye; surface reticulate. Antennae short, inconspicuous, received in distinct grooves on ventral side of thorax, 11-segmented, terminal six serrate (Fig. 49). Pronotum wider than long, basal margin strongly sinuate, anterior margin arcuate; surface finely punctured. Scutellum large, triangular. Elytra broad at base, sides sinuate, apex narrowly rounded; with distinct lateral carinae extending from base to near apex; surface irregularly punctured, pubescence arranged in distinct fasciae. Prosternum obtuse posteriorly. Legs retractile into body grooves; last tarsal segment as long as first four combined.

Comments. This genus was revised by Nicolay and Weiss (1923) but the genus is in need of further study. Wellso et al. (1976) present a key for the species occurring in Michigan (all of which occur in Canada).

Key to species of *Brachys* in Canada

1. Apex of last visible abdominal sternite distinctly pectinate and female with long hairs along emargination; length usually 5.5 mm or more; Ontario and Quebec .... ***ovatus* (Weber)** (p. 305)

   Apex of last visible abdominal sternite weakly crenulate and female without long hairs along emargination; length usually less than 5.5 mm 2

2. Elytra with purple, blue, or green luster, especially in humeral region; apical elytral setae predominately gold; British Columbia to Quebec .... ***aerosus* Melsheimer** (p. 307)

   Elytra dark brassy black; apical elytral setae light gold to silver; Ontario and Manitoba .... ***aeruginosus* Gory** (p. 308)

Tableau des espèces de *Brachys* du Canada

1. Apex du dernier sternite abdominal visible distinctement pectiné, chez la femelle avec de longues soies le long de l'entaille; longueur en général 5,5 mm ou plus; Ontario et Québec .... ***ovatus*** **(Weber)** (p. 305)
   Apex du dernier sternite abdominal visible faiblement crénelé, chez la femelle sans longues soies le long de l'entaille; longueur en général moins de 5,5 mm 2
2. Élytres avec un lustre violet, bleu ou vert, particulièrement dans la région humérale; soies sur l'apex des élytres surtout dorées Colombie-Britannique jusqu'à Québec .... ***aerosus*** **Melsheimer** (p. 307)
   Élytres d'un noir cuivré; soies sur l'apex des élytres doré pâle à argentées; Ontario et Manitoba .... ***aeruginosus*** **Gory** (p. 308)

Brachys ovatus (Weber)

Map 85

Buprestis ovata Weber, 1801:76.

Brachys ovatus: Nicolay and Weiss 1923:68; Knull 1925:56; Chamberlin 1926:99; Craighead 1950:197; Wellso et al. 1971:20.

Trachys aurulenta Kirby, 1837:162.

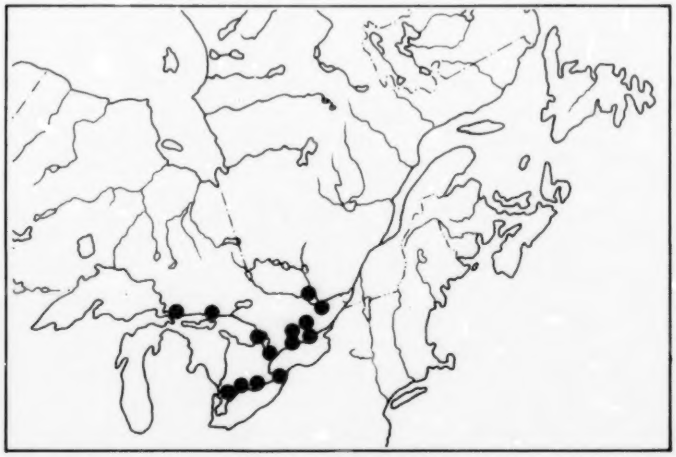
Brachys terminans Laporte and Gory, 1841:3.

Brachys molesta Gory, 1841:332.

Brachys laevicauda LeConte, 1860:252.

Brachys horni Kerremans, 1896:324.

Brachys ovatus var. *bellporti* Nicolay and Weiss, 1923:70.



Map 85. Collection localities of *Brachys ovatus*.

Description. Head and pronotum blackish bronze with very short, stout, recumbent, golden setae; elytra black with purplish or bluish reflection and with variegated color pattern of white and brown or golden setae as follows: a patch of golden setae on each side of scutellar notch, 4 narrow stripes of golden setae extending from base to apical third, a median transverse spot of brown and white setae intermixed, and an apical spot of similarly intermixed brown and white setae. Head strongly convex, longitudinal impression deep; surface shining, reticulate, with very fine, shallow punctures where pubescent, with 2 pairs of weakly elevated callosities, one lateral to eye, one above eye; epistoma rather deeply emarginate. Pronotum about 2.3 times wider than long, widest at base; sides strongly converging anteriorly; disc convex, arcuately impressed along base; surface reticulate, with very shallow, broad, scattered punctures. Elytra broadest at base and at middle; sides constricted between base and middle, expanded at middle, then acutely converging to broadly rounded apex; lateral carina prominent, extending almost to apex; surface shining, shallowly, irregularly punctured, punctures very shallow. Ventral surface finely punctured; subapical margin of last visible ventral sternite emarginate, fringed with long hairs (♀) or broadly rounded to slightly truncate, without hairs (♂); apex of last segment pectinate. Length 4.5-6.0 mm.

Hosts. Feeds on elm (*Ulmus* spp.), sugar maple (*Acer saccharum*), oak (*Quercus* spp.), chestnut (*Castanea* spp.), beech (*Fagus* spp.), and hickory (*Hicoria* spp.).

Distribution. Ontario and Quebec, south to Florida, west to the Rocky Mountains and into Mexico.

Comments. Adults of this species are easily recognized by the larger size and by the presence of long setae on the subapical margin of the last visible abdominal sternite of the female.

Eggs are deposited on the upper leaf surfaces, usually close to the margins. The young larvae enter the leaf directly below the egg and mine in the inner leaf tissue. They form either irregular areas around the eggs or gradually widening, elongate areas away from the eggs and somewhat parallel to and against the leaf margins. The mines are visible on both leaf surfaces, more so on the upper where they appear as brown, dead spots. After becoming full-grown, the larvae leave the mines and pupate on or slightly under the soil surface.

The larvae are slightly wedge-shaped and very flat. The body is composed of 13 well-defined segments and is deeply notched or lobed. The head and mouthparts are dark; the head is retracted into the first segment. The first segment is as broad or slightly broader than those following, and bears a large, well-developed, smooth, shining, subquadrate plate on both dorsal and ventral surfaces; the dorsal plate bears a median groove. The first seven abdominal segments are produced laterally into pronounced, rounded lobes and the lobes on the fifth to ninth segments each bear a group of several, stout, minute spines; the posterior edge of the eighth abdominal segment is also fringed with a row of minute, stout spines.

Both eggs and larvae are parasitized by the larvae of *Closterocerus cinctipennis* Ashmead (Hymenoptera: Eulophidae).

Brachys aerosus Melsheimer

Figs. 49, 263; Map 86

Brachys aerosus Melsheimer, 1845:148; Nicolay and Weiss 1923:71; Knull 1925:56; Chamberlin 1926:95; Craighead 1950:197; Barr 1971:89; Wellso et al. 1971:20.

Brachys aerosus var. *rufescens* Nicolay and Weiss, 1923:72.

Description. Form, coloration, and color pattern similar to *ovatus* but differs by the smaller body size, by the crenulate apex of the last visible abdominal sternite, by the arcuate, glabrous, apical margin of the last visible abdominal sternite of the female, and by the more bluish or purplish reflection on the elytra. Length 3.2–4.5 mm.

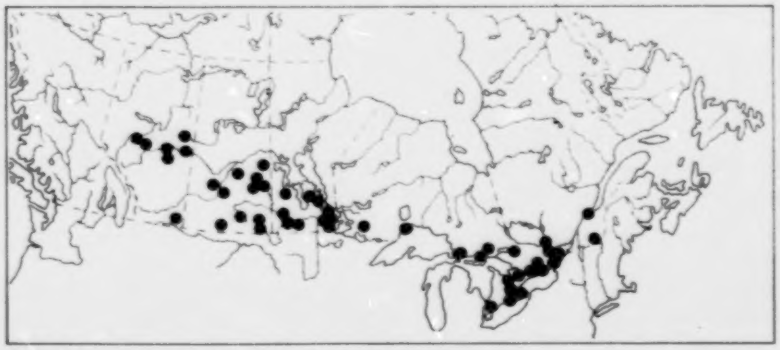
Hosts. Feeds on aspen (*Populus tremuloides*), beech (*Fagus* spp.), linden (*Tilia americana*), witch-hazel (*Hamamelis virginiana*), elm (*Ulmus* spp.), chestnut (*Castanea* spp.), dogwood (*Cornus* spp.), maple (*Acer* spp.), and oak (*Quercus* spp.).

Distribution. Quebec to Alberta, south to Texas and Arizona.

Comments. This species is similar to *ovatus* but the adults may be distinguished easily by the characters listed under description.

This species as currently understood may actually represent a complex of several closely related species. A specimen from British Columbia has been determined by specialists in the United States as "*Brachys* sp. of *aerosus* Melsheimer complex." More study of this group is urgently needed.

The biology of this species is similar to that given for *ovatus*. Also, the larvae of *aerosus* are similar to the larvae of *ovatus*.



Map 86. Collection localities of *Brachys aerosus*.

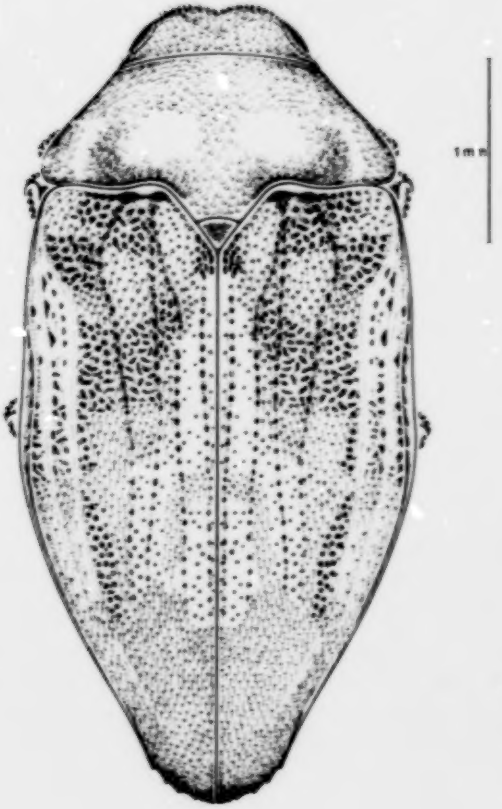


Fig. 263. *Brachys aerosus.*

Brachys aeruginosus Gory

Brachys aeruginosus Gory, 1841:335; Nicolay and Weiss 1923:73; Knull 1925:56; Chamberlin 1926:97; Craighead 1950:197.

Description. Head and pronotum shining black with short, silvery pubescence; elytra shining black to brassy black with scattered silvery setae and few light gold or light brown setae at apex. Head strongly convex, longitudinal impression very deep; surface shining, very finely punctate-reticulate, with pair of callosities above eye, these prominent, glabrous; epistoma very deeply incised. Pronotum 2.3 times wider than long, widest at base; sides strongly converging anteriorly; disc convex, broadly impressed behind middle; surface with large, very shallow, scattered punctures, impunctate on broad area medially. Elytra similar to *ovatus* except in color pattern. Ventral surface as in *aerosus*. Length 3.3–3.75 mm.

Hosts. Mines the leaves of arbutus (*Arbutus* spp.), elm (*Ulmus* spp.), hornbeam (*Carpinus* spp.), hickory (*Carya* spp.), beech (*Fagus* spp.), and willow (*Salix* spp.).

Distribution. Manitoba to Maine, south to Texas and Virginia.

Canadian records. Constance Bay, Ont., ex *Arbutus* leaves; Berthierville, Que., *Salix* spp.

Comments. This is the smallest species of *Brachys* in Canada and can be easily recognized by the size and by the more uniformly black body color with silvery pubescence.

The only Canadian specimens seen were from Ontario and Quebec (see Canadian records); Chamberlin (1926) records Manitoba.

Genus *Taphrocerus* Solier

This genus is quite large in the Neotropical region but only 12 species are recorded from North America. Three species have been identified from Canada but the identification should be considered tentative until a complete revision is available.

Although the host plants of two of the Canadian species is unknown, all evidently live in bulrushes.

Description. Head strongly convex, narrowly longitudinally impressed in front, surface finely punctured with pair of distinct pores between antennal insertions; clypeus broadly incised. Antennae short, segments 6–11 slightly broadened, 1–5 cylindrical (Fig. 48), in repose lying in groove that extends onto thorax. Pronotum wider than long; sides grooved for reception of antennae; anterior margin straight, transverse, posterior margin with truncate median lobe; surface with weak basal impressions. Scutellum triangular, acute posteriorly. Elytra broad, humeral angles prominently elevated; base deeply notched at scutellum; apex narrowly rounded; sides constricted before middle; surface weakly punctate. Prosternum lobed anteriorly, process short, slightly widened posteriorly. Legs slender, fitting snugly into body grooves when retracted.

Comments. This genus was revised by Obenberger in 1934. In the New World, 137 species were recognized, most occurring in the Neotropical region. Wellso et al. (1976) identified three species from Michigan, all of which occur in Canada. Barr (1971) mentions one unidentified species from eastern Washington, which, from the description, appears to be *gracilis*.

Key to species of *Taphrocerus* in Canada

1. Elytra with 4 clumps of white setae almost forming pubescent spot; body robust, about 2.4–2.5 times longer than wide 2
   Elytra evenly, sparsely pubescent, none of the setae arranged into pubescent spots; body slender, about 2.9 times longer than wide; Alberta to Ontario .... ***schaefferi* Nicolay & Weiss** (p. 310)
2. Body black, with distinct violet or bluish reflections; Ontario .... ***nicolayi* Obenberger** (p. 312)
   Body black, without reflections; Alberta to Quebec .... ***gracilis* (Say)** (p. 312)

Tableau des espèces de *Taphrocerus* du Canada

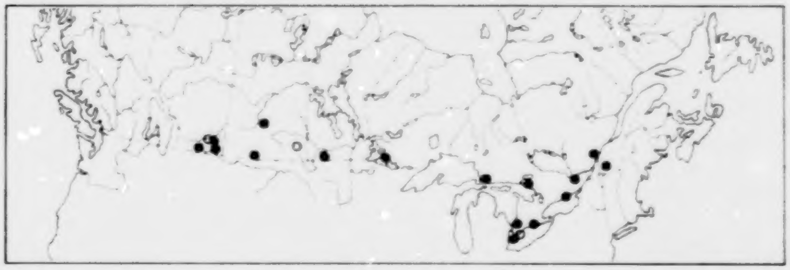
1. Élytres avec 4 touffes de soies blanches formant presqu'une tache pubescente; corps robuste, environ 2,4–2,5 fois plus long que large 2
   Élytres avec une pubescence uniforme et éparse, les soies non disposées de façon à former des taches pubescentes; corps mince, environ 2,9 fois plus long que large; Alberta jusqu'à l'Ontario .... ***schaefferi* Nicolay & Weiss** (p. 310)
2. Corps noir, avec des reflets violets ou bleuâtres distincts; Ontario .... ***nicolayi* Obenberger** (p. 312)
   Corps noir, sans reflets; Alberta jusqu'au Québec ... ***gracilis* (Say)** (p. 312)

Taphrocerus schaefferi Nicolay & Weiss

Fig. 48; Map 87

Taphrocerus schaefferi Nicolay and Weiss, 1920:144; Obenberger 1934:33; Wellso et al. 1976:20.

Description. Head, pronotum, and elytra shining black; elytra with short, recumbent, white, evenly distributed setae. Head strongly convex, with distinct, longitudinal impression extending from middle of frons to occiput, and with a sharp, transverse arcuate carina above antennal insertions, straight between antennal insertions; surface weakly shagreened, with rather long, recumbent, white, flattened setae above frontal carina; epistoma broadly incised; area below frontal carina glabrous, minutely reticulate; with pair of small, deep, median pits located just above frontal carina, several additional pits located around lower margin of eye. Antennae inserted on front of head, bases close, serrate from fifth segment (Fig. 48). Pronotum about 1.9 times wider than long, widest at apical angles; sides weakly sinuate, divergent from apex to base; disc weakly convex, with pair of broad, weak impressions laterally at base and with weak, narrow, transverse impression short distance behind anterior margin; surface minutely reticulate with scattered broad, shallow punctures, each of these with forward projecting setae on posterior margin. Elytra about equal in width at base and basal third; sides distinctly constricted before basal third, expanded just before middle, then convergent to broad, weakly serrulate apices; disc somewhat flattened, with broad, weak,



Map 87. Collection localities of *Taphrocerus gracilis* (•) and *T. schaefferi* (○).

basal impressions; surface punctured in somewhat even rows on basal half, more randomly punctured posteriorly; pubescence evenly distributed, consisting of short, recumbent white setae. Ventral surface finely, sparsely punctured; last visible abdominal sternite broadly rounded at apex with arcuate ridge (♀) or arcuate groove (♂) just before apex. Tibiae slender, unmodified. Tarsi unmodified. Length 3.0–3.7 mm, 2.9 times longer than wide.

Hosts. Yellow nut sedge (*Cyperus esculentus*).

Distribution. Alberta to Ontario, south through eastern and central United States to Colorado and Texas. Recorded from "Vancouver" (Obenberger 1937) but this record needs verification.

Comments. Adults of this species are most easily recognized by the uniformly distributed elytral pubescence.

The biology and immature stages of this species have been reported in detail by Story et al. (1979).

Adults beetles begin to appear in May soon after the host plant begins growth. Adults, at this time, feed on the leaf margins of the host plant. After mating, females move to the taller, more vigorous plants for oviposition. Younger leaves emerging from the center whorl are usually selected; two to six eggs are laid singly on the upper leaf surface, usually on the midrib.

The eggs are oval, flat, and nearly colorless when laid but darken to shiny black after about 2 days. Eggs hatch in about 16 days.

Upon hatching, the first instar larva bores directly into the leaf from the egg. The larva may mine either proximal or distal to the leaf base, but it usually follows the parallel venation. The larva first mines in one direction for about 10 cm, then turns and retraces the mine, increasing the mine width as it moves. The larva continues mining beyond the egg, then once again turns back toward the egg. Molting occurs as the larva approaches the first half of the mine, after about 4 days. The resulting mines are long and narrow, about 1.0 mm wide and 13 cm long.

The second and third instar larvae feed in the central 10 cm portion of the mine. During these stages almost all of the leaf tissue is consumed except near the ventral leaf midsection and along the leaf margins. The second instar takes about 7 days and the third about 12 days.

Pupation occurs inside the central portion of the mine; the pupal stage requires about 12 days. After emerging, the adult remains in the mine for about 3 days, then chews a hole in the upper leaf surface and emerges. Emergence occurs from mid-July to early August. Adults continue to feed on the leaves but disperse from the host habitat by the end of August. Overwintering sites were not found.

A complete description of the third instar larva is given in Story et al. (1979).

Taphrocerus nicolayi Obenberger

Taphrocerus nicolayi Obenberger, 1924:60, 79–80; Obenberger, 1934:20; Wellso et al. 1976:20.

Description. Head black with distinct violet reflection; pronotum black with bluish reflection; elytra black with faint violet reflection, except very dark purple in impressed areas where pubescence is more clustered; ventrally black with bluish or purplish reflections. Head, pronotum, and elytra similar to *schaefferi* except body stouter, about 2.5 times longer than wide, and elytral pubescence generally evenly distributed but clustered into 2 pubescent spots on each elytron, one just behind middle, placed laterally, and one at apical fourth, placed medianly.

Hosts. Unknown.

Distribution. Ontario through the eastern United States to Oklahoma and Georgia.

Canadian record. Roseland, Ont.

Comments. Very little is known of this species. Adults are similar to those of *gracilis* and differ mainly by the bluish and purplish reflections on the body and by the smaller body size.

Taphrocerus gracilis (Say)

Fig. 264; Map 87

Trachys gracilis Say, 1825:253.

Taphrocerus gracilis: Knull 1925:57; Chamberlin 1926:238; Obenberger 1934:19; Wellso et al. 1976:20.

Brachys alboguttatus Mannerheim, 1837:120.

Taphrocerus grossus Obenberger, 1924:55.

Description. Similar in color and body form to *schaefferi* but differs by having pubescent elytral spots and a broader body; similar in elytral pubescence and body form to *nicolayi* but differs by not having bluish or purplish reflections and by having a smaller body.

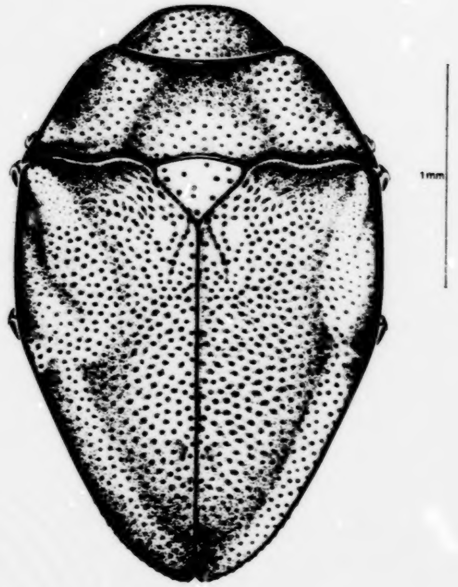


Fig. 264. *Taphrocerus gracilis.*

Hosts. Adults collected from leaves and flowers of buttonbush (*Cephalanthus occidentalis*), oak brush, and myrtle brush. Larvae mine only in leaves of the flood-plain bulrush (*Scripus fluviatilis*).

Distribution. Alberta to Quebec, south through United States to Florida, New Mexico, and California.

Comments. This is the most commonly collected species of this genus in Canada. Adults are similar to those of *nicolayi* but lack the bluish or purplish reflections.

The biology of this species is well known due to the study by Chapman (1923). The following notes are condensed from his report.

The egg of this species is oval and measures about 0.07 by 1.1 mm. It is glued to the leaf surface by the female and adheres so tightly that the egg membrane remains on the leaf throughout the season.

Three larval instars are reported, each instar differing in appearance from the one preceding. First-instar larvae have the general appearance of wood-boring buprestid larvae, that is, the prothorax is very broad in proportion to the slender abdomen. At each side of the head, a small, clublike appendage projects from the prothorax. These appendages are enlarged at their distal ends and are covered with a thin, spinous layer of chitin. These appendages can be retracted to some extent and are used by the larvae in feeding. Second-instar larvae differ from the first by the smaller proportionate size of the prothorax. The body of the second-instar larvae gradually tapers from the broad prothorax to the terminal, or 10th, abdominal segment. A rectangular, chitinous shield is developed on the median area of both the dorsal and ventral sides of the prothorax. Third-instar larvae differ from the second mainly by their size and by the appearance of rudimentary prolegs, or ambulatory ampullae, on the ventral surface of the ninth and 10th abdominal segments.

The pupa resembles the adult in form and shape. All the appendages are closely appressed to the body and the entire body is encased in hard chitin.

In the Ithaca, NY, area, eggs are laid on leaves of the flood-plain bulbrush from the middle of June until the middle of July. As many as four or five eggs may be found on one leaf but one or two is the usual number. Eggs are found on the leaf anywhere from the tip to the base, but most of them are found slightly nearer the tip than the base and about midway between the midrib and the leaf margin. Eggs are white when laid and gradually turn to shiny black. The eggs hatch about 10 days after being deposited.

At eclosion, the larva bores directly into the leaf tissue by eating its way through the egg surface that is adhering to the leaf. It begins feeding at once, forming a blotch mine; the larva continues feeding either toward the leaf tip or toward the leaf base. Completed burrows vary in length from 62 to 170 mm, and they usually extend from the midrib to the leaf margin. Occasionally, several larvae may combine their mines, each larva working in a fresh, untouched part of the leaf.

At the end of each instar the larvae evidently return to the central part of the mine to molt; all cast skins and the pupae are found in this portion of the mine. The larval stage lasts for 3 or 4 weeks, or possibly more, and the pupal stage lasts about 10 days.

Within a few days after emergence, the adult beetles begin feeding on the tender top shoots and leaves of the bulrush. They continue feeding even after the first frosts, but by early October they go into hibernation. The hibernation site is unknown but is presumed to be under debris on higher land, because the ground under the bulrushes is flooded in the spring.

Glossary

aedeagus The sclerotized intromittent organ in male buprestids.

clypeus That part of the head below the frons to which the labrum is attached.

disc The dorsal, central portion of the pronotum or elytra.

epipleuron (pl., **epipleura**) The deflexed or inflexed portion of the elytra, immediately beneath the edge.

epistoma The lower part of the head between the mouth and the frons.

frons The front part of the head between the epistoma and the upper level of eyes.

humerus The basal exterior angle of the elytra.

interstriae The surface between elytral striae.

interval The space between two sculptures or structures.

labrum The upper lip, which covers the base of the mandibles.

maxillary palpul (pl., **maxillary palpi**) A jointed appendage on each maxilla of an insect; sensory in function.

mesepimeron A sclerite (epimeron) of the mesothorax; in buprestids, located lateral to mesocoxae.

meso- Prefix referring to middle, as in mesocoxae, the middle pair of coxae.

meta- Prefix referring to posterior, or last, as in metacoxae, the posterior pair of coxae.

metepimeron A sclerite (epimeron) of the metathorax; in buprestids, located lateral to metacoxae.

metepisternum A sclerite between the first and second lateral thoracic sutures; in buprestids, located just above metasternum.

plantula A lobe of the divided third tarsal segment.

pro- Prefix referring to anterior structures or part of structures, as in procoxae, the anterior pair of coxae.

prosternal process A lobe of the prosternum extending between the procoxae.

pygidium The dorsal portion of the last abdominal segment.

scutellum An oblong or triangular piece between the elytral bases.

sternite The ventral portion of an abdominal segment.

stria (pl., **striae**) A longitudinal, impressed line, usually punctured, extending from the base to apex of the elytra.

strial punctures Refers to punctures in striae.

tarsomere One of the segments of the tarsus.

tergite The dorsal portion of an abdominal segment.

unguifer The median dorsal process or sclerite on the end of the tarsus to which the pretarsal claws are articulated.

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